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ABSTRACT

Presented is a compendium of quantitative information portraying science education in the United States. The data, gathered from a wide variety of sources, are assembled into six chapters including resources, participation, attitudes, goals and needs, test data, degree data, and employment in science and engineering. Each entry consists of a chart and sometimes a corresponding table printed on the same page. Many of the observations on the individual entry pairs are assembled as highlights, introducing each chapter in order to provide a convenient overview of the content of the chapter. (Author/SA)

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Science Education Databook

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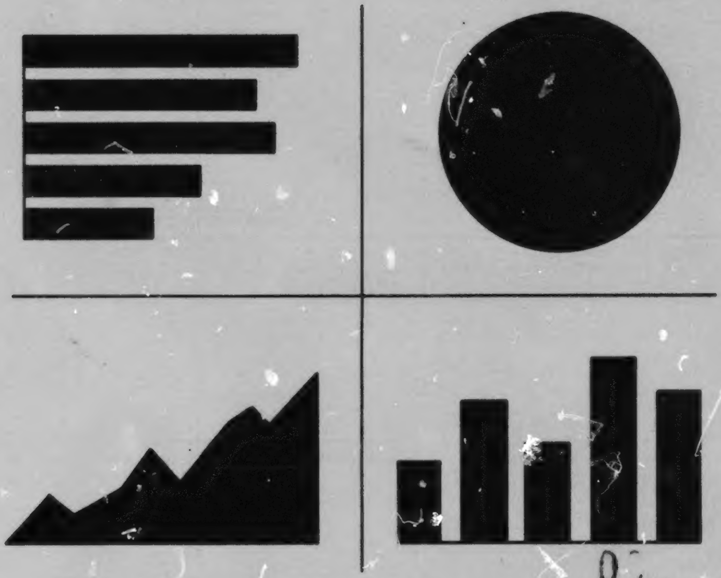

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Introduction

Science and technology play increasingly important and pervasive roles in our society and economy. Thus, *science education,* which must insure an adequate supply of talented and educated personnel for the scientific and technological enterprise and must provide a basic understanding of science to enable all citizens to make informed decisions of personal choice and public policy that involve science and technology, is a central concern of our nation today. While there is a good deal of information available regarding *science* on the one hand, and *education* on the other, there has not been available in one place a compendium of quantitative information portraying *science education* in the United States. This Science Education Databook is intended as a step toward filling that need.

The data have been assembled in six chapters: Resources; Participation; Attitudes, Goals, and Needs; Test Data, Degree Data; and Employment in Science and Engineering. With a few exceptions, each entry consists of a chart and a corresponding table printed on the same page where possible. There is also a brief remark accompanying each entry pair as an example of one of many possible observations that could be made. It should be noted that the data were not necessarily collected originally to support merely that one particular observation. The reader will probably wish to study each chart and table further to glean additional information. Many of these observations on the individual entry pairs are assembled as highlights introducing each chapter in order to provide a convenient overview of the content of the chapter.

The charts and tables in this booklet have been collected from a wide variety of sources as is indicated in the documentation. These sources are also described more fully in the annotated bibliography (see p. 143 ff). These original sources will also be found useful for additional data for those who desire them.

This is the National Science Foundation's first attempt to produce a Science Education Databook since 1960. We hope it is of interest and value to all those concerned about the condition of science education in the United States.

F. James Rutherford
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for Science Education
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Washington, D.C. 20550

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Chapter I
RESOURCES

INTRODUCTION

Resources may be provided by personnel acting as teachers, or by institutions offering courses of instruction, or by society making tax dollars available to support colleges and museums. Resources may take the form of capital, personnel, and teaching materials and may also be expressed in the types of educational programs offered, the curricula used, and the amount of time spent on them.

The resources data contained in this chapter are grouped into three categories: K-12, higher education, and informal education.

HIGHLIGHTS

K-12

1. The fraction of all secondary teachers spending the largest portion of their time in science, mathematics, or social studies increased by almost 22% from 1961 to 1976. (Chart I-1)
2. Slightly more than half of all grade 10-12 science teachers were using one or more of the Federally funded science curriculum materials during the 1976-1977 school year. (Chart I-6)
3. Students in K-3 spend an average of less than 20 minutes a day on science. (Chart I-7)
4. Approximately 90% of the grade 7-12 science classes make use of the metric system. (Chart I-8)
5. Relatively few schools have separate budgets for scientific equipment and supplies. (Chart I-9)
6. Over one-third of K-6 classrooms have no science facilities. (Chart I-10)

Higher Education

1. Between 1969 and 1975 the number of mathematical and physical sciences faculty, as a percentage of total college teaching faculty, decreased by 50%. (Chart I-12)
2. Between 1969 and 1975, the number of biological science faculty, as a percentage of total college teaching faculty, increased by 50%. (Chart I-12)
3. During 1977-78, mathematics, chemistry, and physics faculty accounted for over a third of the approximately 36,000 full-time doctoral faculty in science and engineering departments at Ph.D. granting institutions; the biological sciences faculty approached a fourth of the total. (Chart I-13)
4. NSF has shifted support over time among students, faculty, institutions, and R&D. (Chart I-17)
5. During 1975-76 there were almost 3500 degree credit courses in continuing education for scientists and engineers. There were about 4900 non-credit activities in continuing education. (Charts I-19-20)

Informal Education

Between 1972 and 1978, science and technology centers and museums received slightly over $30 million in Federal funds. (Chart I-21)

Chart I-1: Public secondary school teachers, by subject taught, spring 1961 to spring 1976

The fraction of all secondary teachers spending the largest portion of their time in teaching science, mathematics, or social studies increased by almost 22% from 1961 to 1976.

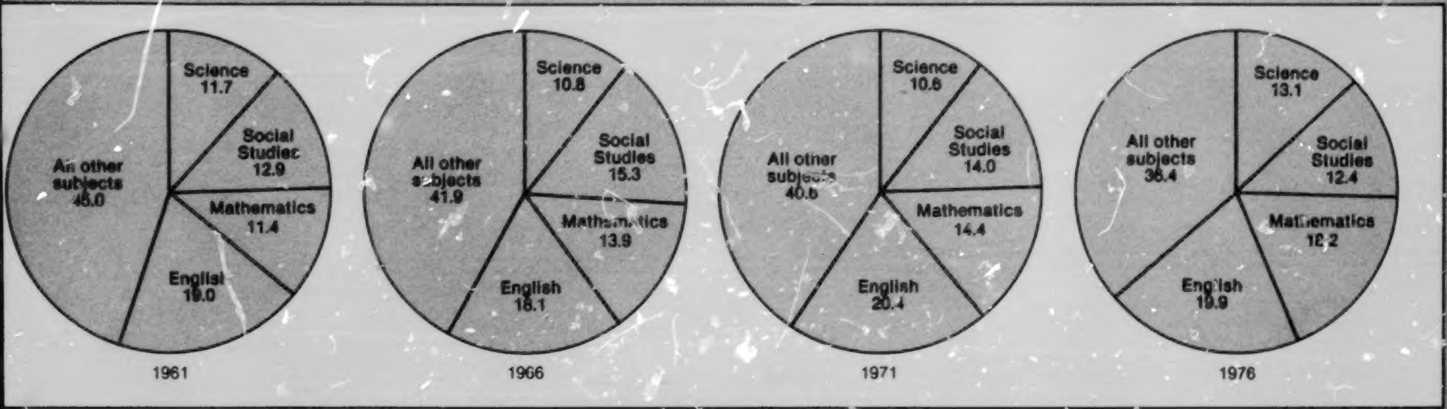


Table I-1: Public secondary school teachers, by subject taught, spring 1961 to spring 1976

(Percentage distribution)

Teaching field in which largest[1] portion of time was spent	1961[2]	1966	1971	1976
1	2	3	4	5
All fields	**100.0**	**100.0**	**100.0**	**100.0**
Agriculture	2.6	1.6	0.6	0.6
Art	2.2	2.0	3.7	2.4
Business education	7.6	7.0	5.9	4.6
English	19.0	18.1	20.4	19.9
Foreign language	4.1	6.4	4.8	4.2
Health and physical education	8.2	6.9	8.3	7.9
Home economics	5.1	5.9	5.1	2.8
Industrial arts	5.5	5.1	6.2	3.9
Mathematics	11.4	13.9	14.4	18.2
Music	1.7	4.7	3.8	3.0
Science	11.7	10.8	10.6	13.1
Social studies	12.9	15.3	14.0	12.4
Special education	0.3	0.4	1.1	3.0
Other	1.0	1.9	1.0	4.0

[1] Half-time or more

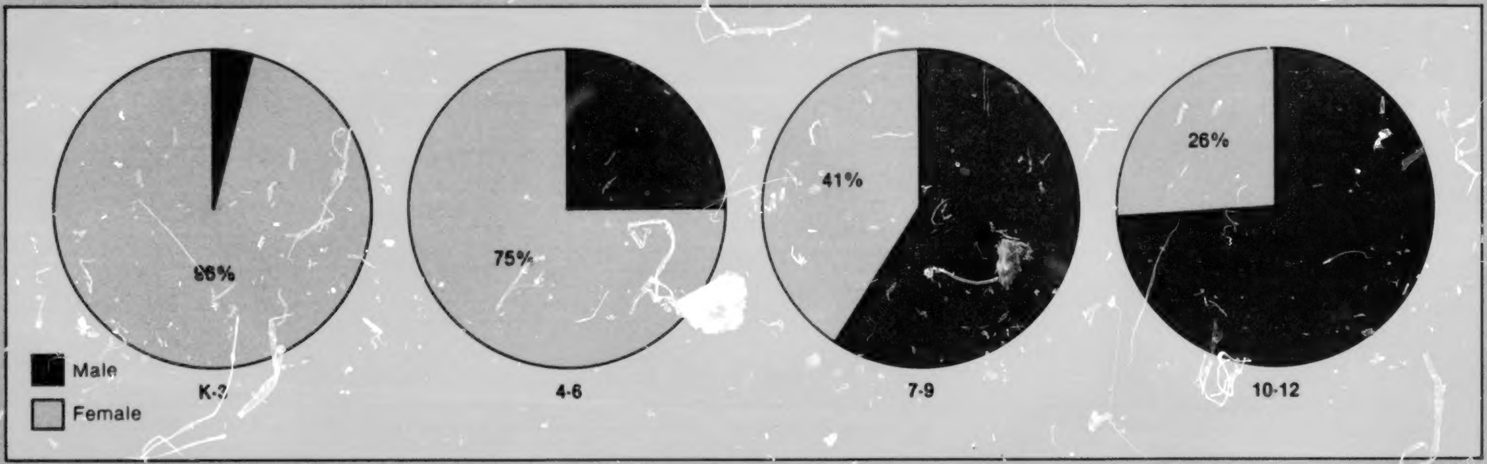
[2] Data add to 93.3 percent. The remaining 6.7 percent reported teaching two or more subjects (each half time or less).

NOTE: Data are based upon sample surveys of public school teachers. Because of rounding, percents may not add to 100.0.

Source: National Education Association, *Status of the American Public School Teacher, 1975-76.* (Copyright © 1977 by the National Education Association. All rights reserved.) Reprinted from Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1977-78,* p. 53.

Chart I-2: Percent of male and female science, mathematics, and social studies teachers, by grade range

Most elementary school teachers are women. They usually teach science, mathematics, and social studies as well as other subjects. Most high school teachers of mathematics, science, and social studies are men and they usually teach within one subject field.



Source: Weiss, Iris R., *et al*, *The Status of Pre-College Science, Mathematics, and Social Studies Education Practices in U.S. Schools: An Overview and Summaries of Three Studies*, Highlights Report, p. [illegible].

Table I-2: Percent of male and female teachers of science, mathematics, and social studies, by grade range

Grade Range	*Mathematics*			*Science*			*Social Studies*			*Total*		
	Male	Female	Unknown	Male	Female	Unknown	Male	Female	Unknown	Male	Female	Unknown
K-3 (N = 838)	6	94	0	2	98	0	3	96	1	4	96	0
4-6 (N = 829)	21	76	2	33	67	0	19	79	1	25	74	1
7-9 (N = 1538)	54	46	0	62	38	0	62	38	0	59	41	0
10-12 (N = 1624)	68	32	0	74	24	2	75	24	1	73	26	1
Sample N		1672			1679			1478			4829	

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 141.

Chart I-3: Most Frequently Used Social Studies Textbooks/Programs by Grade Range[1]

Textbook/Program	Percent of K-3 Classes
Laidlaw Social Science Program (King)	14
Social Sciences: Concepts and Values (Brandwein)	9
Concepts & Inquiry Series	5
Our Working World (Senesh)	3
Investigating Man's World Program	3
Silver Burdett Social Science (Anderson)	3
Focus on Active Learning: Social Studies	3
Contemporary Social Science Curriculum (Anderson)	2
Holt Databank System for Elementary Social Studies, (Fielder)	2
Map & Globe Skills (Nasaland)	2

Textbook/Program	Percent of 4-6 Classes
Exploring Series	14
Social Sciences: Concepts and Values (Brandwein)	13
Laidlaw Social Science Program (King)	10
Contemporary Social Science Curriculum (Anderson)	7
Man and His World Series	5
Concepts & Inquiry Series	4
Tiegs-Adams Series	4
Field Social Studies Program	3
Holt Databank System for Elementary Social Studies (Fielder)	3
Focus on Active Learning: Social Studies	2
Silver Burdett Social Science (Anderson)	2

Textbook/Program	Percent of 7-9 Classes
This is America's Story (Wilder)	5
The Free and the Brave (Graff)	4
America: Its Peoples and Values (Wood)	3
Liberty and Union: A History of the U.S. (Ridge)	3
Quest for Liberty (Chapin)	3
Challenge & Change (Eibling)	2
American Civics (Hartley)	2
Foundations of Freedom (Eibling)	2

Textbook/Program	Percent of 10-12 Classes
Rise of the American Nation (Todd)	7
Magruder's American Government (McClenaghan)	5
Economics: Principles and Practices (Brown)	4
Carnegie-Mellon Social Studies Curriculum Project—Holt Social Studies (Fenton)	3
History of a Free People (Bragdon)	3
Sociology: The Study of Human Relationships (Thomas)	3
American History (Abramowitz)	2
Concepts in American History (Morzello)	2
Medieval and Early Modern Times (Hayes)	2
Men and Nations: A World History (Mazour)	2
Modern History (Becker)	2

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[1] Teachers were given a list of titles and asked 1) to select the ones their sample class used, and 2) to further select *the one* "used most often." These data represent the responses to the second question. Teachers were able, as well, to report titles not on the list. Where a book has more than one author, only the first one listed is used. Programs include a variety of combinations: frequently a book with manipulative materials, or tapes, or individually paced card sets, etc.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, pp. B-46-47.

Chart I-4: Most Frequently Used Science Textbooks/Programs by Grade Range[1]

Textbook/Program	Percent of K-3 Classes
Concepts in Science (Brandwein)	12
Science: Understanding Your Environment (Mallinson)	5
New Laidlaw Science Program (Smith)	5
Heath Science Series (Schneider)	4
Science Curriculum Improvement Study (SCIS): Life Science	4
Modern Elementary Science (Fischler)	4
Science: A Process Approach (SAPA)	2
Science Curriculum Improvement Study (SCIS): Physical Science	2
Modular Activities Program in Science (Berger)	2
Kindergarten Keys (Economy)	2

	Percent of 4-6 Classes
Concepts in Science (Brandwein)	16
Science: Understanding Your Environment (Mallinson)	10
New Laidlaw Science Program (Smith)	7
Today's Basic Science Series (Navarra)	7
Elementary Science: Learning by Investigating (ESLI)	5
Heath Science Series (Schneider)	5
Steck-Vaughn Elementary Science Series (Ware)	4
Introductory Physical Science (Haber-Schaim)	3
Science: A Process Approach (SAPA)	3
Science Curriculum Improvement Study (SCIS): Life Science	3
Investigating in Science (Jacobson)	2
Science Curriculum Improvement Study (SCIS): Physical Science	2

Textbook/Program	Percent of 7-9 Classes
Focus on Earth Science (Bishop)	8
Intermediate Science Curriculum Study: Probing the Natural World	7
Principals of Science Series (Heimler)	6
Introductory Physical Science (IPS) (Haber-Schaim)	4
Living Things (Fitzpatrick)	3
Study Lessons in General Science (Gross)	3
Focus on Life Science (Heimler)	3
Modern Science Series (Blanc)	3
Life: Its Forms and Changes	3
Modern Biology (Otto)	2
Modern Earth Science (Ramsey)	2
Life in the Environment (Navarra)	2
Interaction of Man and the Biosphere: Inquiry in Life Science (Abraham)	2

	Percent of 10-12 Classes
Modern Biology (Otto)	12
Modern Chemistry (Metcalfe)	7
Biological Science: An Ecological Approach (BSCS Green)	6
Biological Science: An Inquiry Into Life (BSCS Yellow) (Moore)	4
Biology: Introduction to Life (Nason)	3
Biology: Living Systems (Oram)	3
College Physics (Schaum)	3
Modern Physics (Williams)	3
Biology (Kroeber)	2
Biological Science: Molecules to Man (BSCS Blue)	2
Biology (Smallwood)	2
The Project Physics (Rutherford)	2
Modern Physical Science (Tracy)	2

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[1] Teachers were given a list of titles and asked 1) to select the ones their sample class used, and 2) to further select *the one* "used most often." These data represent the responses to the second question. Teachers were able as well to report titles not on the list. Where a book has more than one author, only the first one listed is used. Programs include a variety of combinations: frequently a book with manipulative materials, or tapes, or individually paced card sets, etc.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, pp. B-44-45.

Chart I-5: Most Frequently Used Mathematics Textbooks/Programs by Grade Range[1]

Textbook/Program	Percent of K-3 Classes
Holt School Mathematics (Nichols)	18
Mathematics Around Us: Skills and Applications (Bolster)	13
Modern School Mathematics: Structure and Use (Duncan)	8
Elementary School Mathematics (Eicholz)	8
The Understanding Mathematics Program (Gundlach)	8[2]
Investigating School Mathematics (Eicholz)	5
Exploring Elementary Mathematics (Keedy)	4
Heath Elementary Mathematics Program (Dilley)	3
Mathematics for Individual Achievement (Denholm)	2
Laidlaw Mathematics Series (McSwain)	2
Silver Burdett Mathematics System (LeBlanc)	2
Using Numbers (Gundlach)	2

	Percent of 4-6 Classes
Holt School Mathematics (Nichols)	19
Modern School Mathematics: Structure and Use (Duncan)	10
Mathematics Around Us: Skills and Applications (Bolster)	9
Investigating School Mathematics (Eicholz)	9
Elementary School Mathematics (Eicholz)	8
Exploring Elementary Mathematics (Keedy)	5
Laidlaw Mathematics Series (McSwain)	4
Mathematics for Individual Achievement (Denholm)	4
Silver Burdett Mathematics System (LeBlanc)	4
Heath Elementary Mathematics Program (Dilley)	3
Unifying Math (Deans)	3

Textbook/Program	Percent of 7-9 Classes
Holt School Mathematics (Nichols)	7
Modern Algebra: Structure and Method (Dolciani)	7
Exploring Modern Mathematics (Keedy)	6
Modern School Mathematics: Structure and Method (Dolciani)	6
Modern Mathematics Through Discovery (Morton)	5
School Mathematics (Eicholz)	4
Mathematics Around Us: Skills and Applications (Bolster)	4
Elementary Algebra (Denholm)	3
The Understanding Mathematics Program (Gundlach)	3
Refresher Mathematics (Stein)	2
Fundamentals of Mathematics (Stein)	2
Modern School Mathematics: Pre-Algebra (Dolciani)	2
Modern School Mathematics: Structure and Use (Duncan)	2

	Percent of 10-12 Classes
Modern Algebra and Trigonometry: Structure and Method (Dolciani)	13
Modern School Mathematics: Geometry (Jurgensen)	12
Modern Algebra: Structure and Method (Dolciani)	4
Geometry (Jurgensen)	3
Geometry (Morgan)	3
Modern Introductory Analysis (Dolciani)	3
Algebra II with Trigonometry (Smart)	2
Holt Algebra II with Trigonometry	2

[1] Teachers were given a list of titles and asked 1) to select the ones their sample class used and 2) to further select *the one* "used most often." These data represent the responses to the second question. Teachers were able as well to report titles not on the list. Where a book has more than one author, only the first one listed is used. Program includes a variety of combinations: frequently a book with manipulative materials, or tapes, or individually paced card sets, etc.

[2] This percent includes the percent of use for *Using Numbers* (Gundlach) which is a part of the program.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, pp. B-42-43.

Chart I-6: Percent of teachers using Federally funded curriculum materials in each subject by grade range[1]

Use of Federally funded curricula tends to increase with increasing grade level. Slightly more than of all grade 10-12 science teachers were using one or more of the Federally funded science curricu materials during the 1976-77 school year.

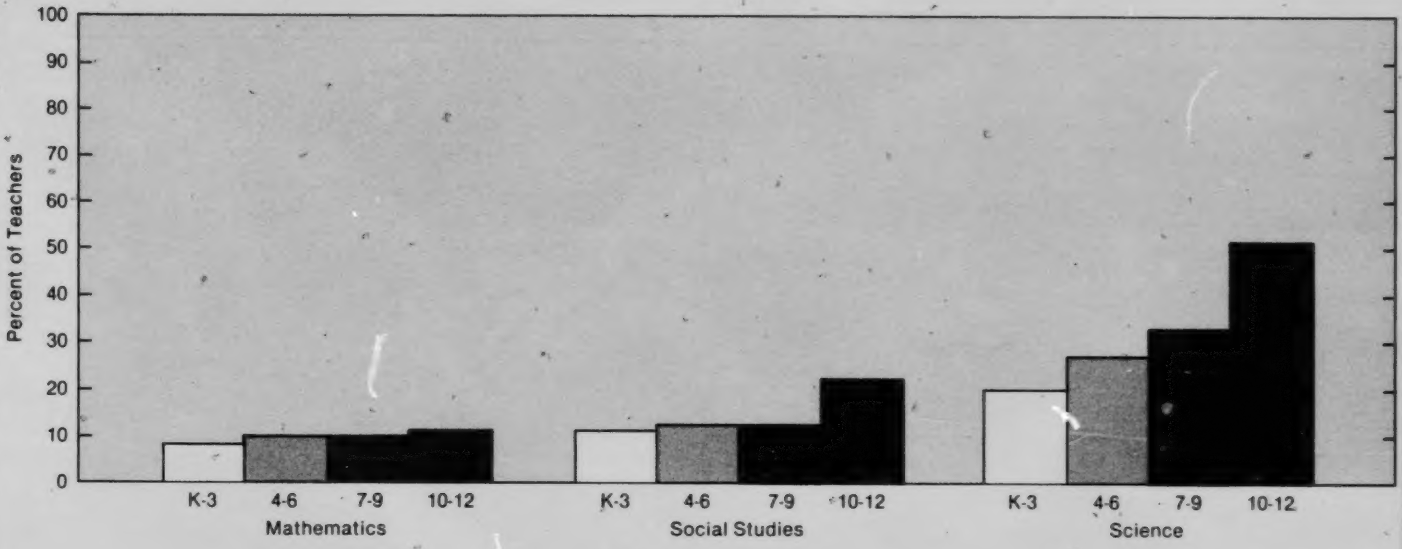


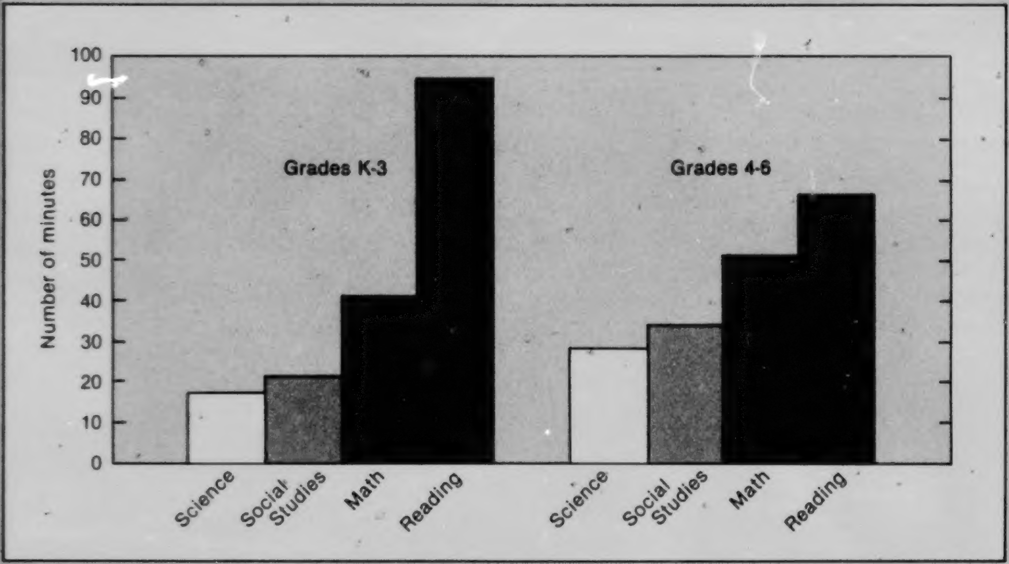
Table I-6: Percent of teachers using Federally funded curriculum materials in each subject by grade range

	Subject									Total		
	Mathematics			Social Studies			Science					
Grade Range	Yes	No	Unknown/ Inconsistent	Yes	No	Unknown/ Inconsistent	Yes	No	Unknown/ Inconsistent	Yes	No	Unknown/ Inconsisten
K-3 (N = 838)	8	80	12	11	80	10	20	69	11	13	76	11
4-6 (N = 829)	10	80	11	12	75	13	27	61	12	16	72	12
7-9 (N = 1538)	10	84	6	12	84	4	33	61	6	18	77	5
10-12 (N = 1624)	11	86	3	22	73	5	52	44	5	28	68	4
Sample N	1672			1478			1979			4829		

[1] Teachers were given a list of textbooks/programs the development of which had been federally financed, and asked to indicate 1) general familiarity and use, and 2) which, if any, they were using during 1976-77 ("using" could mean that the textbook/program was being used exclusively or as one of many). These data represent responses to the second question.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 83.

Chart I-7: Average number of minutes per day spent teaching each subject in self-contained classes, by grade range[1]



Students in Grades K-3 spend an average of about 20 minutes each day on science and on social studies. The difference between the amount of time spent on reading and that spen on other subjects decreases from K-3 to 4-6.

Table I-7: Average number of minutes per day spent teaching each subject in self-contained classes, by grade range[1]

	Grade Range					
	K-3		*4-6*		*Total*	
Subject	Average Number of Minutes	Standard Error	Average Number of Minutes	Standard Error	Average Number of Minutes	Standard Error
Mathematics	41	.61	51	.43	44	.38
Science	17	.24	28	.64	20	.28
Social Studies	21	.62	34	.71	25	.53
Reading	95	1.60	66	1.34	86	1.18
Sample N	467		302		769	

[1] Teachers self-reported these data.

NOTE: Only teachers who indicated they teach mathematics, science, social studies, and reading to one class of students were included in these analyses.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 51.

Chart I-8: Percent of mathematics and science classes that use metric concepts by subject and grade range.

The use of metric concepts increases with increasing grade level in science classes; approximately 90% of the 7-9 and 10-12 science classes make use of the metric system.

In mathematics classes, use is higher in the lower grades; by grades 10-12 only 56% of mathematics classes use metric concepts.

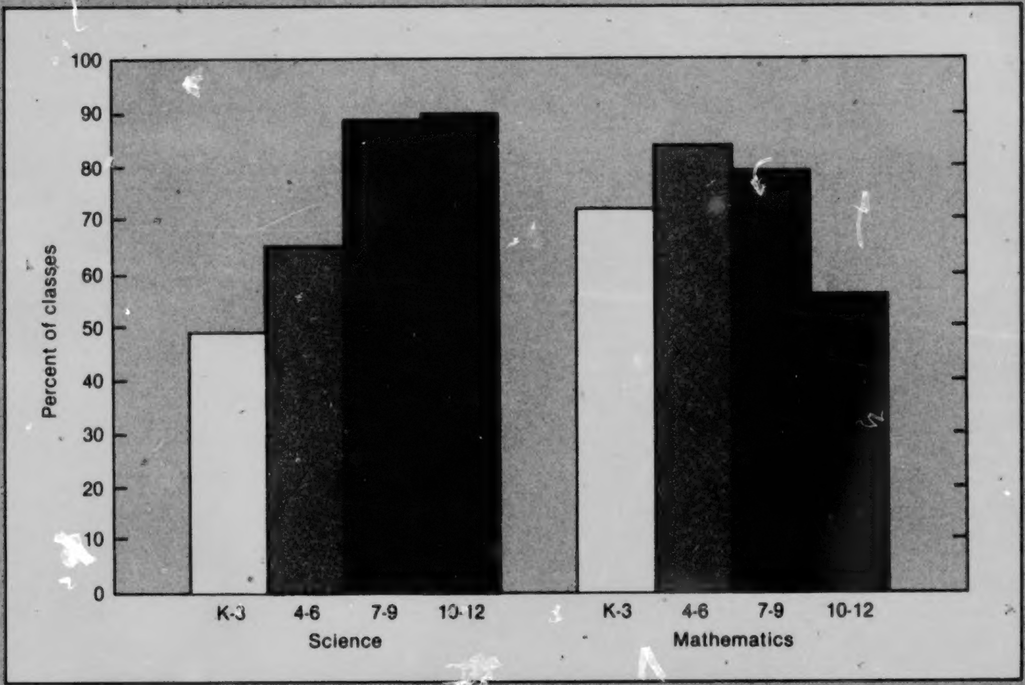


Table I-8: Percent of mathematics and science classes that treat metric concepts in each of a number of ways, by subject and grade range

	Mathematics					Science				
Use of Metric Concepts	K-3	4-6	7-9	10-12	Total	K-3	4-6	7-9	10-12	Total
Not Used	26	13	20	43	24	42	31	10	7	26
Special Metric Unit Only	42	43	34	7	35	22	19	13	8	17
Used Special Metric Unit and Used Throughout Course	8	22	22	5	15	13	20	40	44	27
Introduced as Needed	22	19	23	44	25	14	26	36	38	26
Missing	2	3	1	1	2	9	4	1	3	5
Sample N	297	277	550	548	1672	287	271	535	586	1679

Source: Weiss, Iris R, *Report of the 1977 Survey of Science, Mathematics, and Social Studies Education*, p. 119.

Chart I-9: Percent of schools with specific budgets for science equipment and science supplies, and average amounts of these budgets per pupil, by grade range

Relatively few schools have specific budgets for science equipment and supplies. In general, schools are somewhat more likely to have specific budgets for supplies than for equipment, and secondary schools are much more likely than elementary schools to have specific budgets for both. The per pupil amounts of science budgets for secondary schools are considerably larger than those for elementary schools, but to the extent the middle schools have such budgets at all, they are not much smaller than those in grades 10-12.

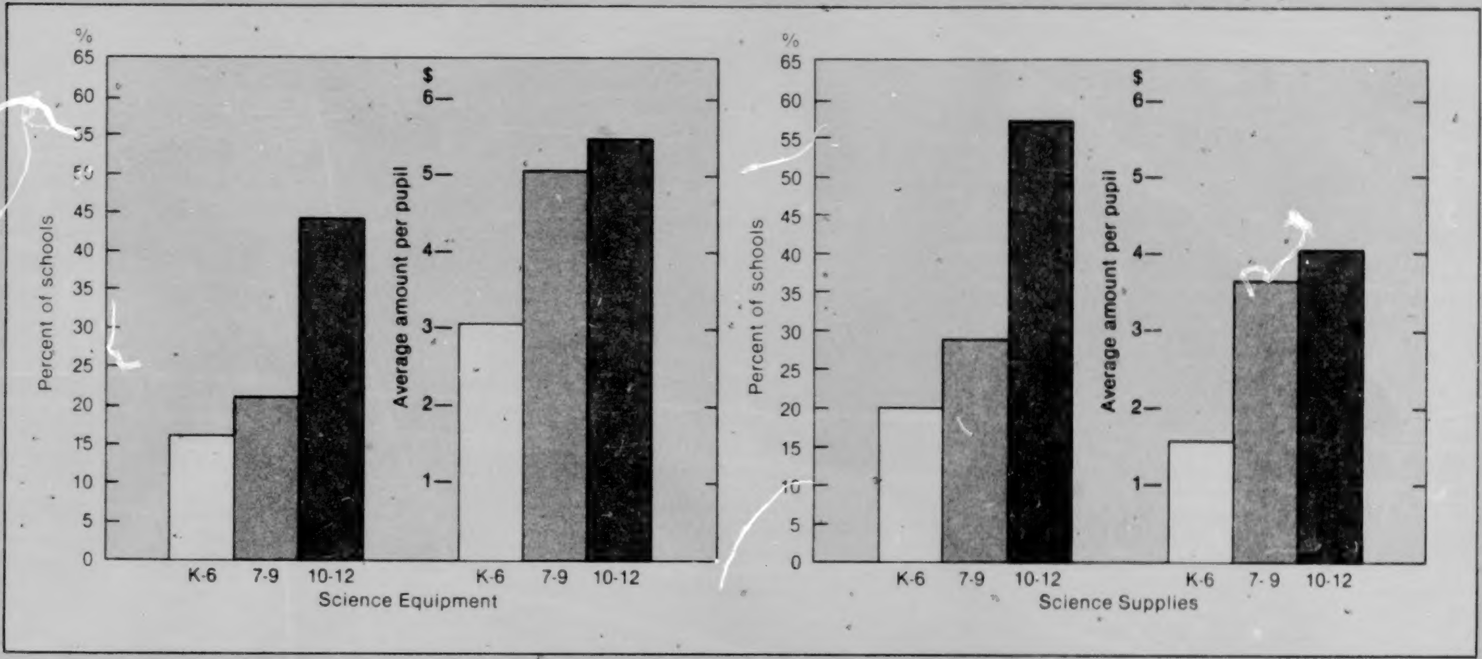


Table I-9: Percent of schools with specific budgets for science equipment and science supplies, and average amount of these budgets per pupil by sample grade range[1]

	Science Equipment				Science Supplies			
Sample Grade Range	Sample N	Percent of Schools	Average Budget Amount	Standard Error	Sample N	Percent of Schools	Average Budget Amount	Standard Error
K-6	107	16	$3.05	$ .31	155	20	$1.56	$ .15
7-9	119	21	$5.03	$2.09	176	29	$3.62	$1.25
10-12	117	44	$5.46	$ .84	180	57	$4.02	$ .65

[1] Schools that reported there was a specific budget but did not indicate the amount, and schools that did not indicate total enrollment were not included in the calculations of average amounts per pupil.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 126

Chart I-10: Percent of elementary science classes conducted in various types of rooms

Slightly more than half of all elementary school classes receive science instruction in classrooms with portable science materials. Only 4% of the elementary science classes (and virtually all of these are grades 4-6) are conducted in laboratories or special science rooms. More than a third of the classes are conducted in classrooms with no science facilities at all.

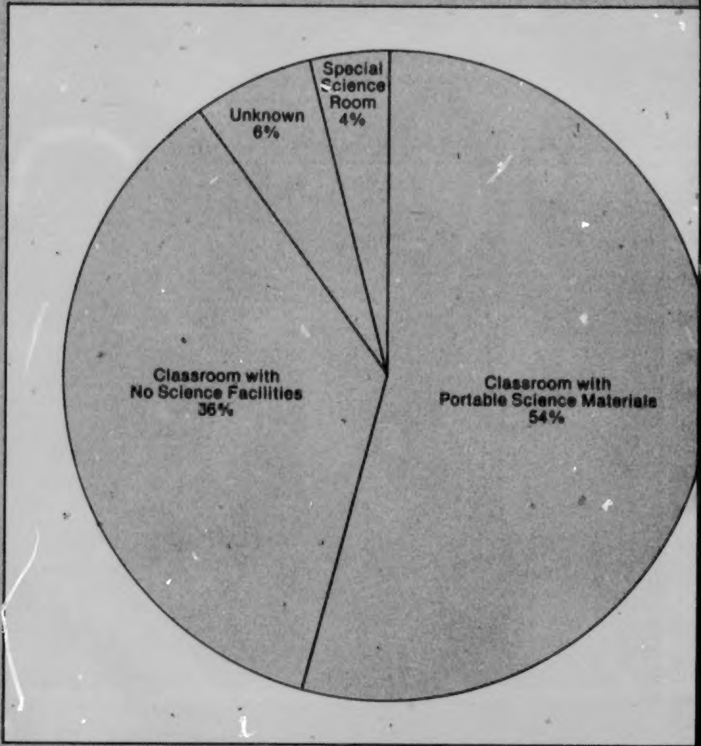


Table I-10: Percent of elementary science classes conducted in various types of rooms, by grade range

Type of Room	Grade Range		
	K-3	4-6	Total
Laboratory or special science room	0	9	4
Classroom with portable science materials	54	54	54
Classroom with no science facilities	38	34	36
Unknown	8	3	6
Sample N	287	271	558

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 129.

Chart I-11: Percent of schools with various kinds of equipment, by grade range.

With a few minor exceptions, the availability of science equipment is directly related to grade level wit the higher grades getting more equipment. Microscopes and models are the most frequently en countered equipment.

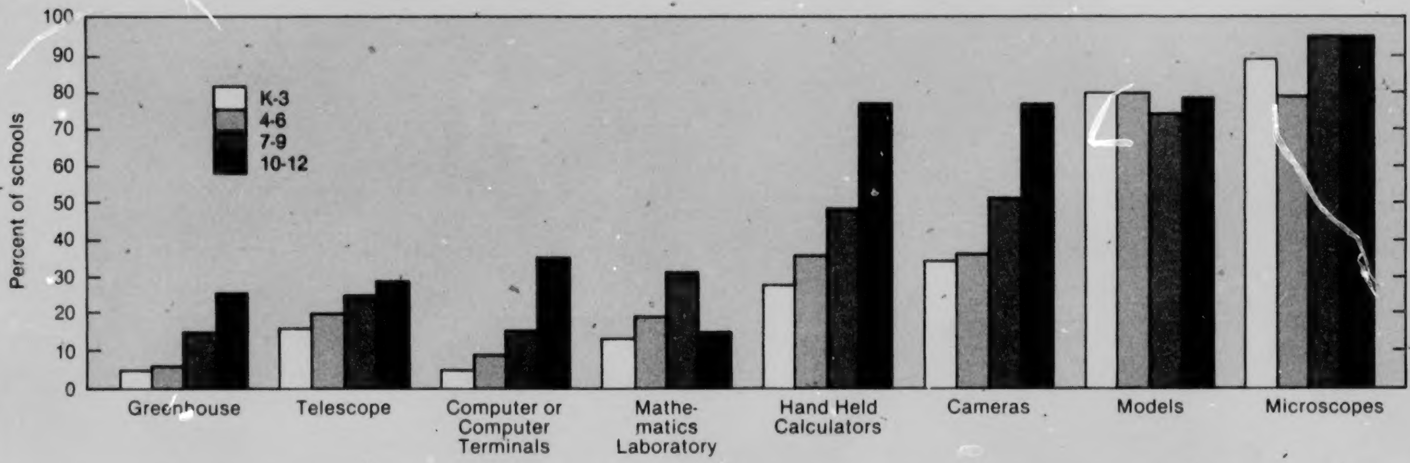


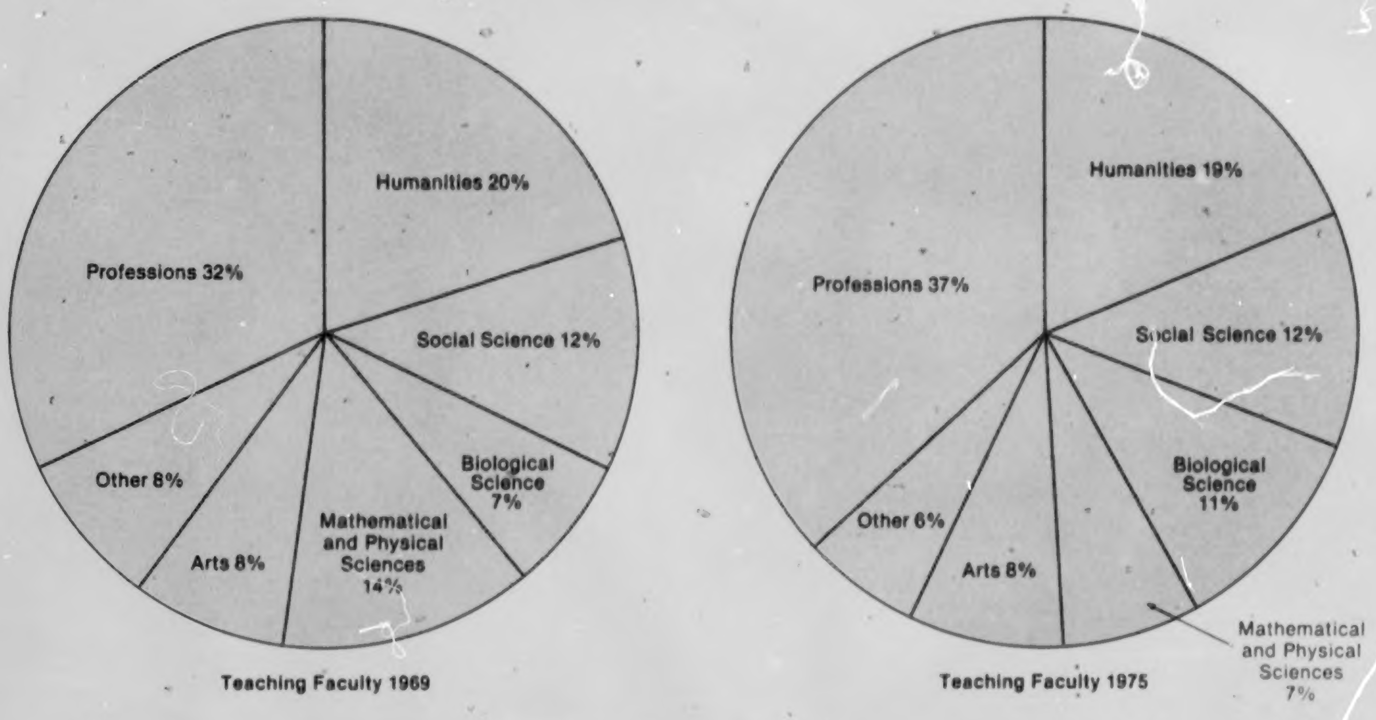
Table I-11: Percent of schools with various kinds of equipment, by sample grade range

Equipment	Sample Grade Range K-3	4-6	7-9	10-12
Computer or Computer Terminals	5	9	16	36
Greenhouse	5	6	15	26
Telescope	16	20	25	29
Darkroom	11	16	37	75
Weather Station	7	10	14	22
Hand-held Calculators	28	36	49	77
Microscopes	89	79	95	95
Cameras	34	36	51	81
Models (e.g., of the solar system, parts of organisms, etc.)	80	80	74	79
Small Group Meeting Rooms	48	40	56	59
Resource Center for Individualized Instruction	45	45	51	44
Mathematics Laboratory	13	19	31	15
Sample N	317	292	298	270

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 127.

Chart I-12: Percentages of teaching faculty in higher education in subject fields 1969 and 1975

The biological, mathematical and physical sciences underwent major faculty shifts during the first half of the 1970s. As a percentage of total faculty, the mathematical and physical sciences' share decreased by 50% while the biological sciences' share increased by a like amount. The professions showed a 16% gain while the remaining subjects held steady. These shifts are consistent with shifts in undergraduate enrollments (Chart II-8).



Teaching Faculty 1969

Teaching Faculty 1975

Source: Carnegie Foundation for the Advancement of Teaching, *Missions of the College Curriculum*, p. 10[illegible] (revised with permission of author.)

Chart I-13: Full-time doctoral faculty in science & engineering departments at Ph.D.-granting institutions, 1977-1978

During 1977-78, there were 35,962 full-time doctoral faculty in science and engineering departments Ph.D.-granting institutions. Mathematics, chemistry, and physics accounted for 12,620 positions, 35% of the total number of doctoral faculty in these 16 science fields. Faculty in the biologic sciences, i.e. biology, biochemistry, botany, microbiology, and zoology, totaled 8,103, or 23% of t total.

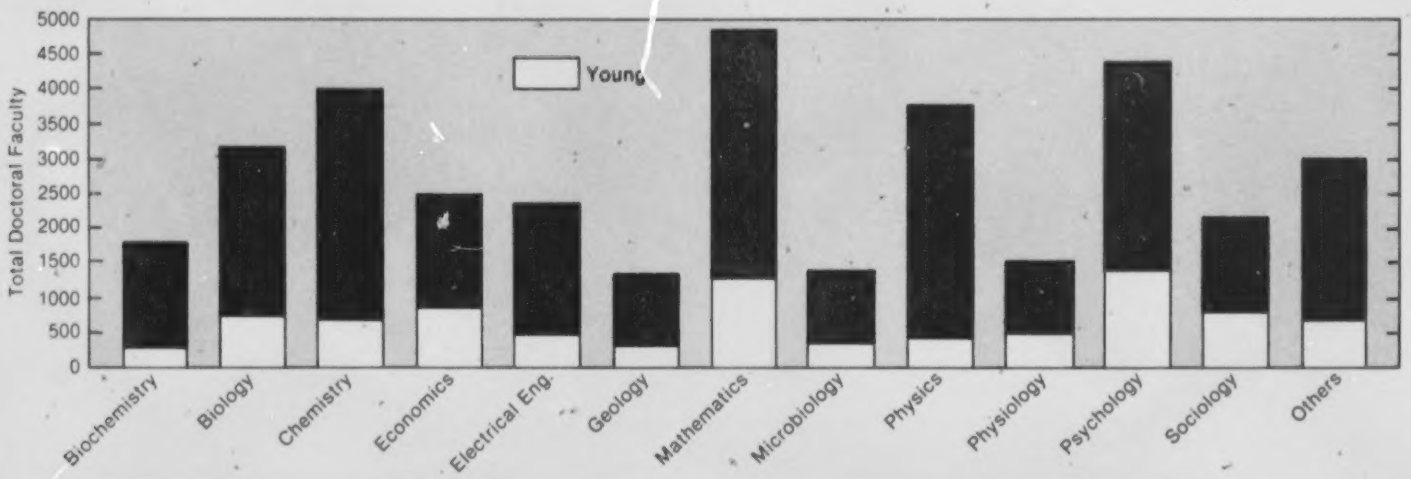


Table I-13: Full-time doctoral faculty and young[1] doctoral faculty in selected science and engineering departments, 1977-78: All Ph.D.-granting institutions (N = 288)

Field	Number of Departments	Total Doctoral Faculty	Young Doctoral Faculty	
			Number	Percent of Total
Biochemistry	129	1,746	294	16.8
Biology	134	3,132	724	23.1
Botany	50	842	139	16.6
Chemical Engineering	96	994	208	21.0
Chemistry	183	3,994	690	17.3
Economics	115	2,468	845	34.2
Electrical Engineering	113	2,355	479	20.4
Geology	97	1,319	305	23.2
Mathematics	151	4,845	1,298	26.8
Microbiology	122	1,385	328	23.7
Mining and Mineral Engineering	11	108	25	23.9
Physics	156	3,781	488	12.9
Physiology	104	1,505	405	27.0
Psychology	174	4,344	1,382	31.8
Sociology	121	2,140	775	36.2
Zoology	47	998	259	26.0
All Fields	1,809	35,962	8,652	24.1

[1] "Young" was defined as describing a person who had received a doctorate in the last 7 years.

Note: Because each data item was separately weighted and rounded, subtotals generally approximate, but may not add exactly to their corresponding totals. Reported percentages reflect the true proportions of the weighted numerical totals. Since the decimals associated with the numbers of faculty were eliminated without rounding, the percentages may not appear to be exact.

Source: Atelsek, Frank J. and Gomberg, Irene L., *Young Doctoral Faculty in Science and Engineering; Trends in Composition and Research Activity*, p. 17.

Chart I-14: Percent of higher education institutions with access to computers, 1965-77

The percent of institutions with access to computers has more than doubled since 1965.

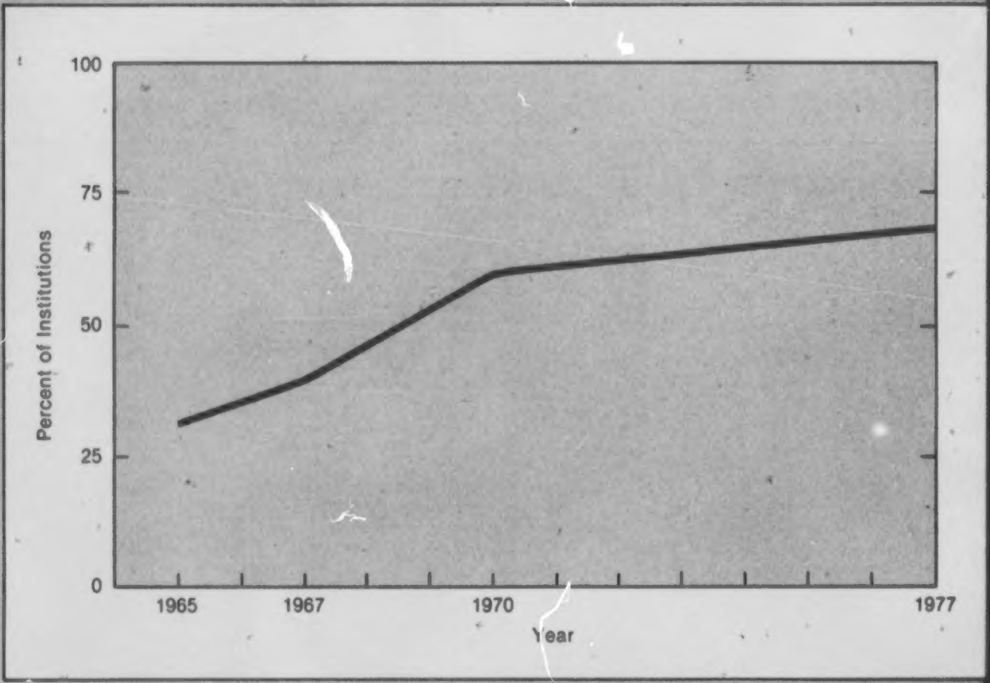


Table I-14: Estimated number and percent of U.S. institutions of higher education with access to computer facilities

	No. Institutions		
	Total	With access to computers	Percent with access to computers
SREB/NSF .... 1964-65 Survey June 30, 1965	2219	707	32%
SREB/NSF .... 1966-67 Inventory June 30, 1967	2477	980	40%
SREB/NSF .... 1969-70 Inventory June 30, 1970	2807	1681	60%
FICHE/NSF .... *1976-77 Inventory June 30, 1977	3136	2163	69%

*Table I-14a: Estimates of numbers of institutions with access to computers by highest level of offering June 30, 1977

Highest Level of Offering	Fall '75 Enrollment (millions)	Total # Institutions	# Institutions with access to computers	Percent with access to computers
Associate ...	4.0	1196	801	67
Bachelor's...	.9	801	496	62
Master's	2.4	717	538	75
Doctorate ...	3.9	422	328	78
Total	11.2	3136	2163	69

Source: Hamblen, John W. and Baird, Thomas B., *Fourth Inventory Computers in Higher Education*, pp. II-04,05.

Charts I-15, A&B: National Science Foundation, Instructional Scientific Equipment Program (ISEP) Data

Data from the Instructional Scientific Equipment Program, the major federal support of scientific equipment for undergraduate education, show fluctuations in proposal pressure, and a constant level o funding coupled with rising average requests.

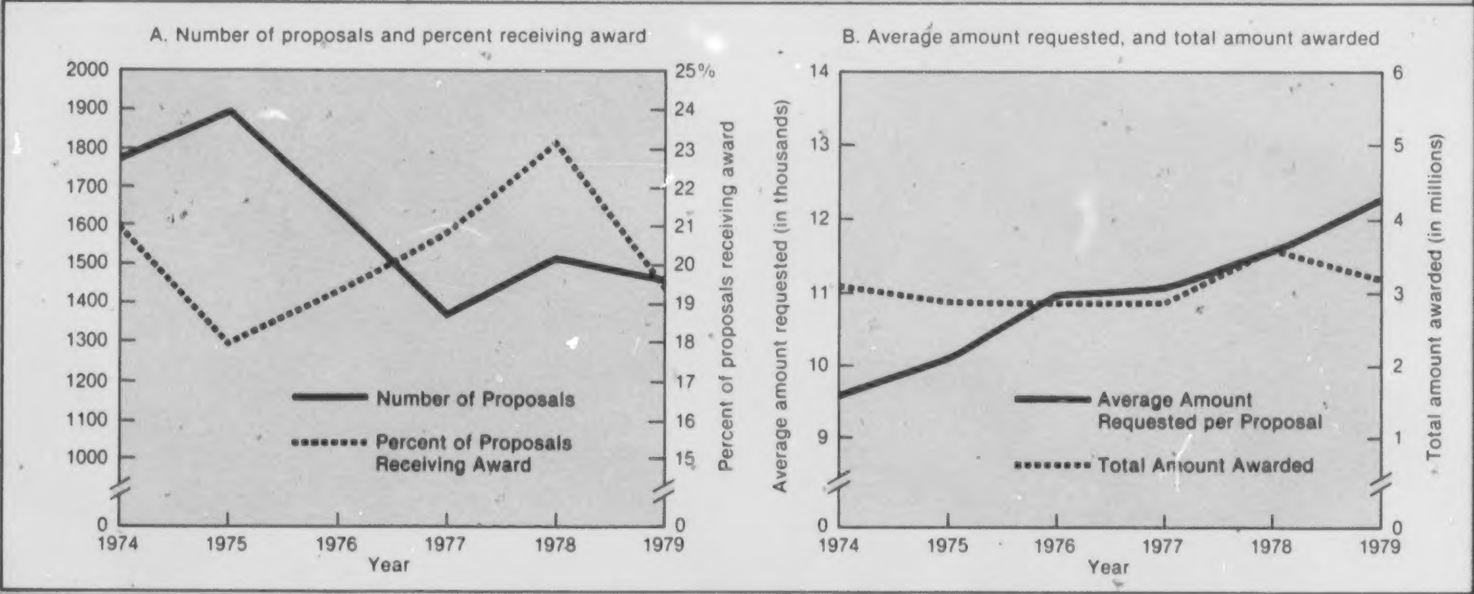


Table I-15: National Science Foundation, Instructional Scientific Equipment Program (ISEP) data

	1974	1975	1976	1977	1978	1979
Number of Proposals Received	1,774	1,891	1,649	1,378	1,515	1,457
Total Amount Requested	$16,982,753	$19,045,381	$18,137,196	$15,254,800	$17,595,900	$17,965,936
Average Amount of Requests	9,573	10,071	10,998	11,070	11,614	12,330
Total Amount Awarded	$ 3,111,700	$ 2,928,800	$ 2,940,000	$ 2,875,200	$ 3,553,300	$ 3,223,277
Percent of Proposals Receiving Award	21.0	18.0	19.4	20.9	23.2	19.5

Source: Directorate for Science Education, National Science Foundation, unpublished data.

Chart I-16: National Science Foundation Science Education obligations by function as percent of total

The National Science Foundation has shifted support over time among students, faculty, institutions and R&D.

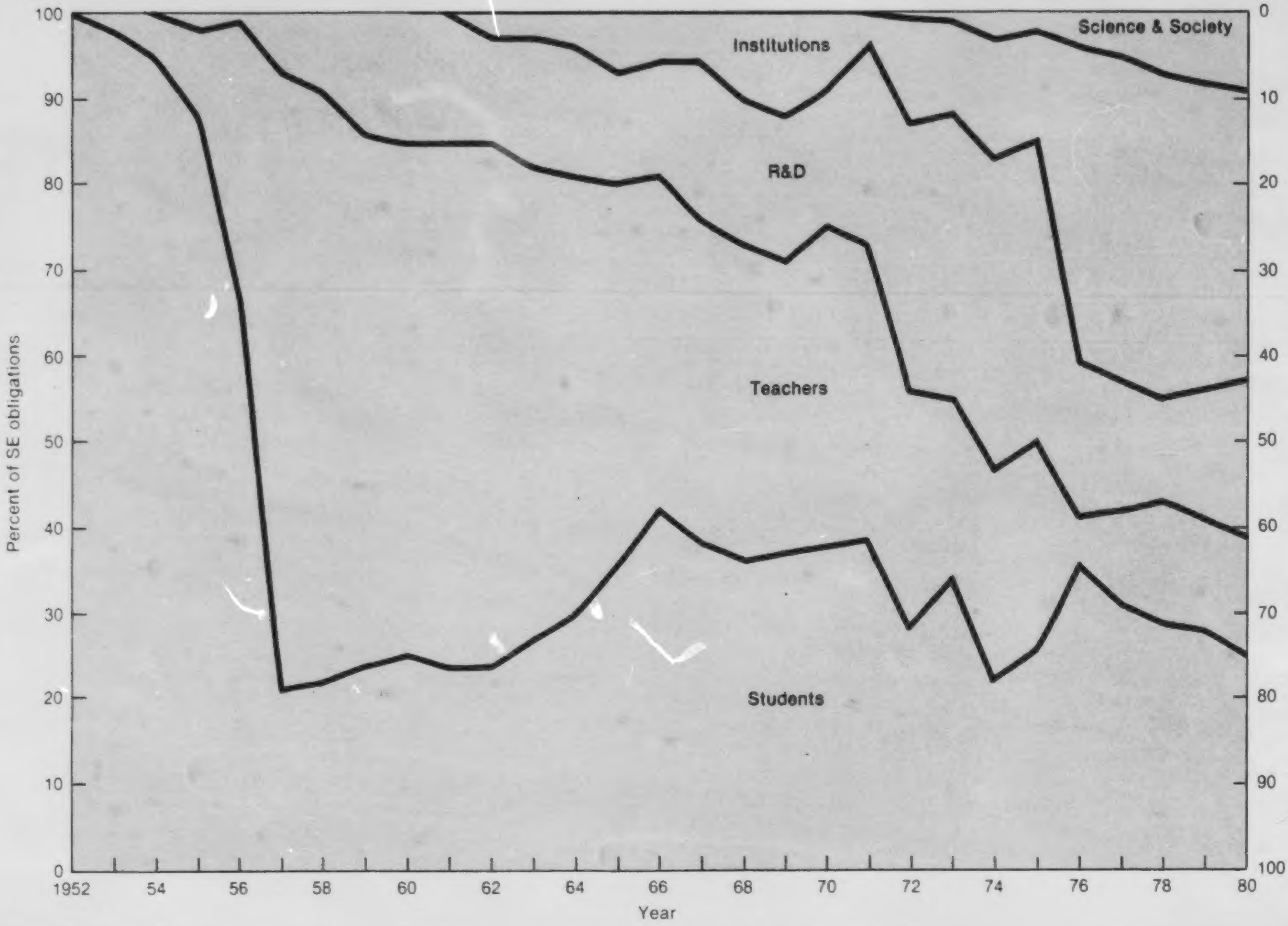


Table I-16: Estimated National Science Foundation Science Education obligations by function, by year (in millions of dollars

Fiscal Year	Total SE dollars	FUNCTIONS*									
		R&D**		Students		Teachers		Institutions		Science and Society	
		%	$	%	$	%	$	%	$	%	$
1952	$ 1.54	0	0	99.7	1.535	0.3	0.005	0	0	0	0
1953	1.41	0	0	98	1.38	2	0.03	0	0	0	0
1954	1.89	0	0	95	1.796	5	0.09	0	0	0	0
1955	2.10	3	0.06	88	1.85	10	0.21	0	0	0	0
1956	3.52	0.4	0.01	67	2.36	32	1.13	0	0	0	0
1957	14.30	7	1.00	21	3.00	72	10.30	0	0	0	0
1958	19.20	9	1.73	22	4.22	69	13.25	0	0	0	0
1959	61.29	14	8.58	24	14.71	62	38.00	0	0	0	0
1960	63.74	14	8.92	25	15.94	60	38.24	0	0	0.5	0.32
1961	63.44	15	9.52	24	15.23	61	38.70	0	0	0.5	0.32
1962	83.60	12	10.03	24	20.01	61	51.00	3	2.51	0.4	0.33
1963	98.72	15	14.81	27	26.65	55	54.30	3	2.96	0.4	0.39
1964	111.23	15	16.68	30	33.37	51	56.73	4	4.45	0.4	0.44
1965	120.41	13	15.65	36	43.35	44	52.98	7	8.43	0.3	0.36
1966	124.30	13	16.16	42	52.21	39	48.48	6	7.46	0.1	0.12
1967	125.82	17	21.39	38	47.81	38	47.81	6	7.55	0.3	0.38
1968	134.46	16	21.51	36	48.41	37	49.75	10	13.45	0.2	0.27
1969	115.30	18	20.75	37	42.66	34	39.20	12	13.84	0.2	0.23
1970	120.18	15	18.03	38	45.67	37	44.47	9	10.82	0.2	0.24
1971	98.81	23	22.73	38	37.55	35	34.58	4	3.95	0.4	0.40
1972	86.10	33	28.41	28	24.11	28	24.11	12	10.33	0.8	0.69
1973	62.23	34	21.16	34	21.16	21	13.07	11	6.85	1	0.62
1974	80.71	36	28.79	22	18.13	25	19.96	14	11.61	3	2.42
1975	74.03	35	26.65	26	19.00	24	17.90	13	10.00	2	1.49
1976	62.50	17	10.63	36	22.50	6	3.75	37	23.13	4	2.50
1977	74.30	15	11.15	31	23.03	11	8.17	38	28.23	5	3.72
1978	73.96	12	8.83	29	21.45	14	10.35	38	28.10	7	5.18
1979	80.00	14	11.20	28	22.40	13	10.40	36	28.80	8	6.40
1980	84.70	18	15.25	25	21.18	14	11.86	34	28.80	9	7.62
Total	2,043.79										

Estimates may not equal total due to rounding.

*The functional categories of obligations are exemplified as follows. *Students* includes programs such as fellowships and precollege student science training. *Faculty* includes programs such as teacher institutes and faculty short courses. *Institutions* includes programs such as ISEP (equipment purchasing), LOCI (Local Course Improvement), and CAUSE (Comprehensive Assistance to Undergraduate Science Education). *Science and society* includes programs for improving the public understanding of science and studying the ethical issues in science and technology.

**Until 1977 development projects received most of the R&D funding.

Source: Directorate for Science Education, National Science Foundation, unpublished data.

Chart I-17: National Science Foundation Science Education obligations by level of education as percent of total

In regard to levels of education, NSF has shifted priorities over time. Funding of graduate and precollege education has become less significant, and undergraduate education more important.

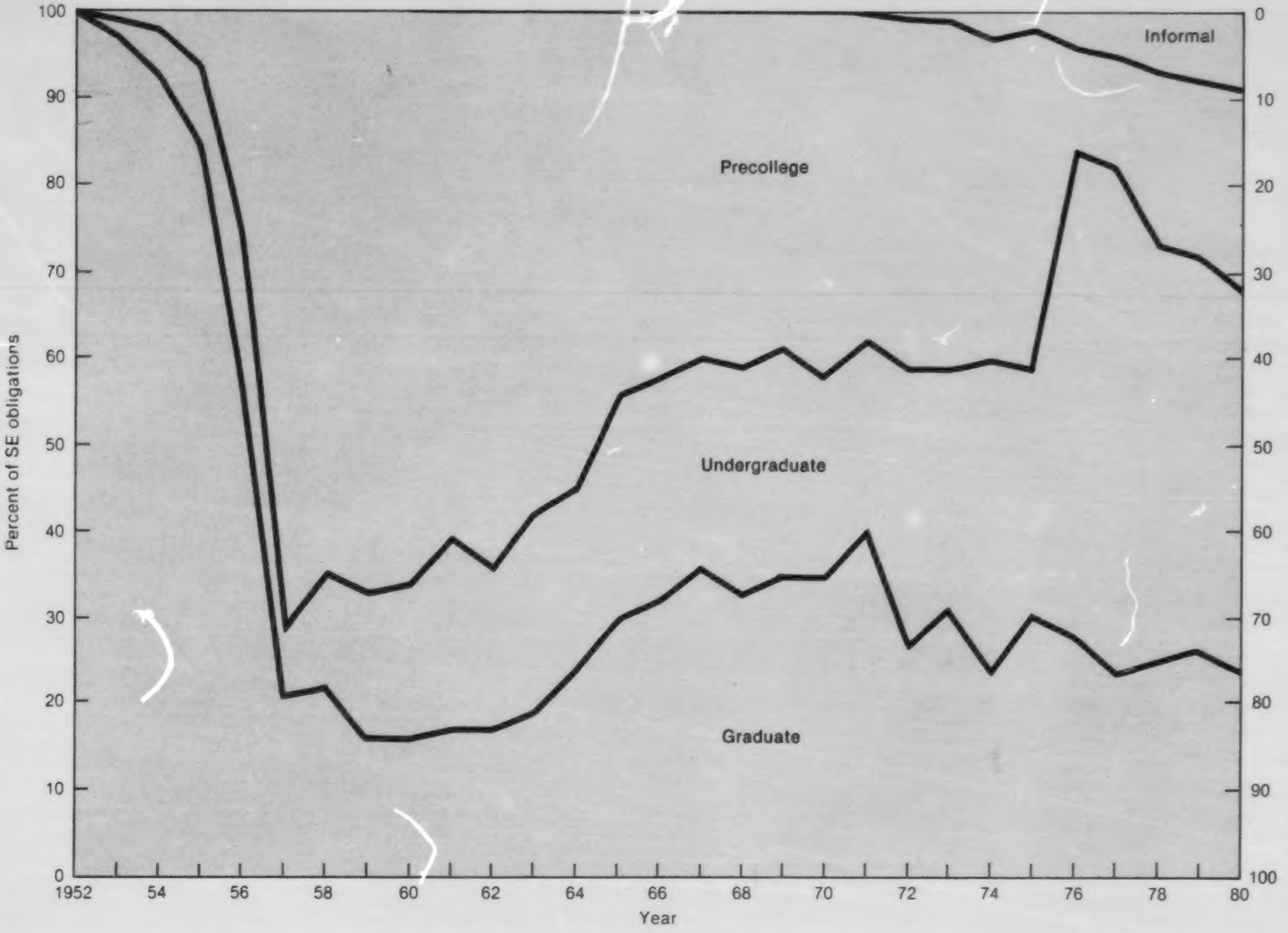


Table I-17: Estimated National Science Foundation Science Education obligations by level of education, by year (in millions of dollars)

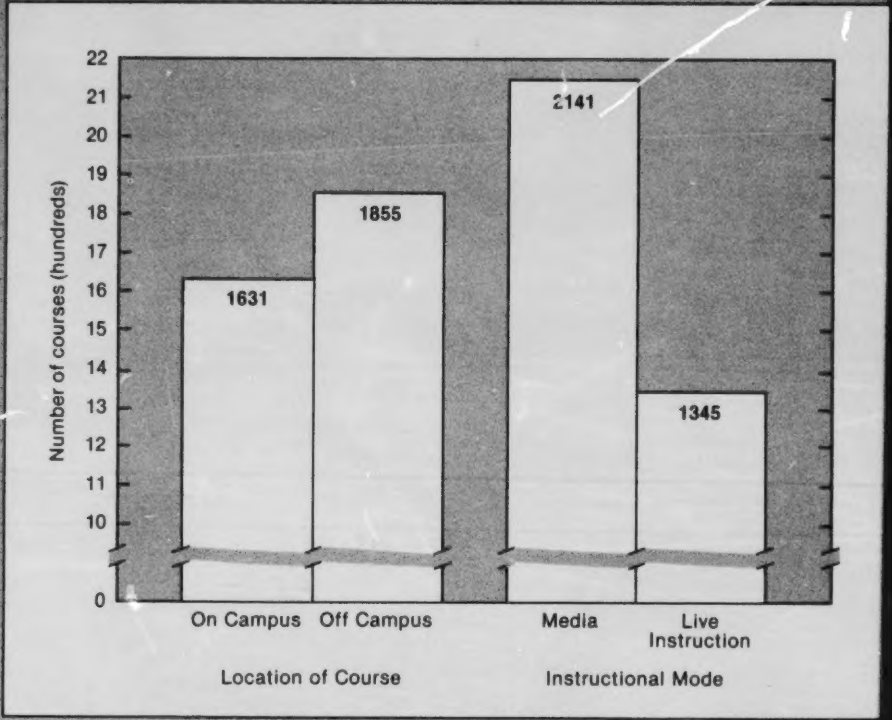
Fiscal Year	Total SE	LEVEL							
		Precollege		Undergraduate		Graduate		Informal	
		%	$	%	$	%	$	%	$
1952	1.54	0	0	0.3	.005	99.7	1.54	0	0
1953	1.41	0.7	0.01	2	.03	97	1.37	0	0
1954	1.89	2	0.04	5	.09	93	1.76	0	0
1955	2.10	6	0.13	9	.19	85	1.79	0	0
1956	3.52	24	0.85	16	.56	59	2.08	0	0
1957	14.30	71	10.15	8	1.14	21	3.00	0	0
1958	19.20	66	12.67	13	2.50	22	4.22	0	0
1959	61.29	67	41.06	17	10.42	16	9.81	0.03	0.02
1960	63.74	65	41.43	18	11.47	16	10.20	0.5	0.32
1961	63.44	61	38.70	22	13.96	17	10.78	0.5	0.32
1962	83.60	63	52.67	19	15.88	17	14.21	0.4	0.33
1963	98.72	57	56.27	23	22.71	19	18.76	0.4	0.39
1964	111.23	54	60.06	21	23.36	24	26.70	0.4	0.44
1965	120.41	44	52.98	26	31.31	30	36.12	0.3	0.36
1966	124.30	42	52.21	26	32.32	32	39.78	0.1	0.12
1967	125.82	40	50.33	24	30.20	36	45.30	0.3	0.38
1968	134.46	40	53.78	26	34.96	33	44.37	0.2	0.27
1969	115.30	39	44.97	26	29.98	35	40.36	0.2	0.23
1970	120.18	42	50.48	23	27.64	35	42.06	0.2	0.24
1971	98.81	37	36.56	22	21.74	40	39.52	0.4	0.39
1972	86.10	41	35.30	32	27.55	27	23.25	0.8	0.69
1973	62.23	39	24.29	28	17.42	31	19.29	1.0	0.62
1974	80.71	38	30.67	36	29.06	24	19.37	3	2.42
1975	74.03	38	28.13	29	21.47	30	22.21	2	1.48
1976	62.50	12	7.50	56	35.00	28	17.50	4	2.50
1977	74.30	13	9.69	58	43.10	24	17.83	5	3.72
1978	73.96	19	14.05	48	35.50	25	18.49	7	5.18
1979	80.00	20	16.00	46	36.80	26	20.80	8	6.40
1980	84.70	23	19.48	44	37.27	24	20.33	9	7.62
Total	2,043.79								

(Estimates may not equal total due to rounding.)

Source: Directorate for Science Education, National Science Foundation, unpublished data.

Chart I-18: Number of continuing education degree credit courses for scientists and engineers

A continuing education degree credit course is defined to be a course directed primarily towards engineers and scientists with at least a bachelor's degree, but excluding courses directed primarily toward full-time students. Fifty-six universities offered 3486 such courses in 1975-76.



Source: Klus, John P. and Jones, Judy A., *Survey of Continuing Education Activities for Engineers and Scientists*, pp. 15-17

Chart I-19: Number of continuing education non-credit activities for scientists & engineers, offered by universities and professional/technical organizations, 1975-76

During 1975-1976, there were 4909 separate activities for scientists and engineers. Of that total, 3519, or 72%, were given by universities and 1390, or 28%, by professional societies. Institutes and other brief programs (i.e., activity of less than 30 accumulated hours) were the most popular form of activity. There were 2223 institutes, 45% of the total.

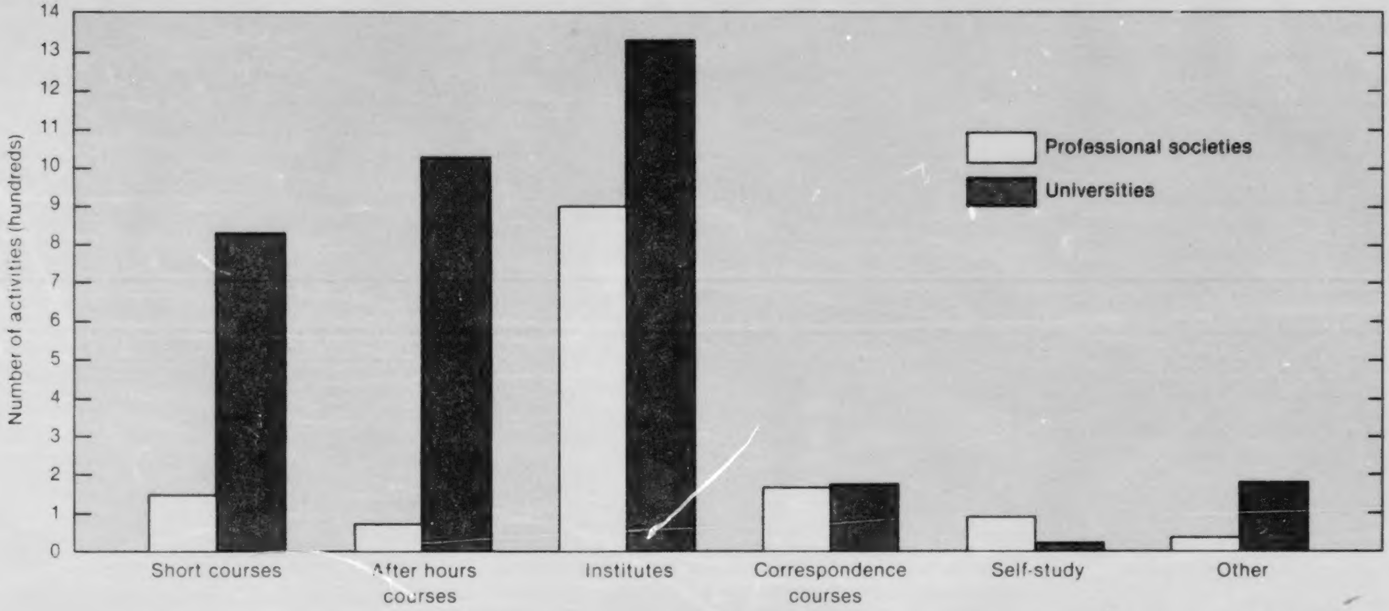


Table I-19: Number of continuing education non-credit activities for scientists and engineers offered by universities and professional/technical organizations, 1975-76

Institution	Number with one or more	Number of activities	Type of Activity*					
			Short courses	After-hours courses	Institutes	Correspondence courses	Self-study	Other
Universities	92	3519	821	1015	1323	167	19	174
Professional/Technical Organizations	55	1390	145	67	900	162	83	33
Total	147	4909	966	1082	2223	329	102	207

*The activities are defined as follows. *Short course* — organized instructional program on a specific subject that meets in all-day sessions for a minimum of 5 days amounting to at least 30 clock hours. *After-hours course* — organized instructional program on a specific subject presented in short segments over a pre-determined number of weeks. *Institute* — also called seminar, clinic, workshop; organized instructional program meeting for 5 hours or more in continuous sessions except for meals and recesses, lasting for less than 30 clock hours. *Correspondence course* — course of instruction involving a continuing exchange between instructor and student conducted primarily by written communication. *Self-study* — program of instruction in which student is provided with all materials and left to proceed on his/her own with no direct aid from an instructor.

Source: Klus, John P. and Jones, Judy A., *Survey of Continuing Education Activities for Engineers and Scientists*, pp. 6-15.

Chart I-20: Federal funding of science-technology centers and museums[1]

Although these data are preliminary and come from a draft report, they serve to give a good estimate of federal support to science-technology centers and museums. Between 1972 and 1978, the Federal government made grants of slightly over $30 million. National History museums received about $12.2 million, general museums $9.2 million, science-technology centers $6.9 million, and aquariums and zoos $2.6 million.

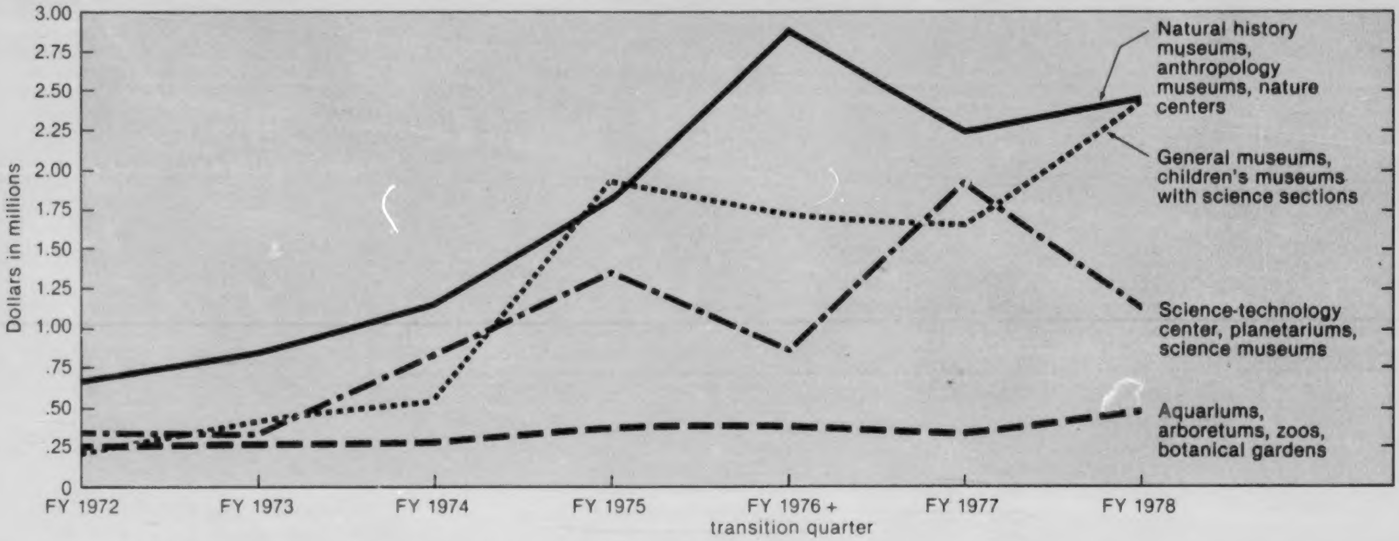


Table I-20: Federal funding of science-technology centers and museums

Museum Type	FY 1972	FY 1973	FY 1974	FY 1975	FY 1976	FY 1977	FY 1978
Science-Technology Centers, Planetariums, Science Museums	$ 360,117	$ 344,317	$ 839,727	$1,375,396	$ 861,191	$1,958,492	$1,126,745
Natural History Museums, Anthropology Museums, Nature Centers	$ 693,096	$ 860,602	$1,172,517	$1,825,954	$2,951,405	$2,264,400	$2,444,954
Aquariums, Aboretums, Zoos, Botanical Gardens	$ 254,900	$ 272,850	$ 289,060	$ 443,457	$ 415,100	$ 360,115	$ 584,624
General Museums, Children's Museums with science sections	$ 230,250	$ 420,865	$ 535,105	$1,957,518	$1,765,742	$1,739,542	$2,581,727
TOTALS	$1,538,363	$1,898,634	$2,836,409	$5,602,325	$5,993,438	$6,322,549	$6,738,050

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[1] Challenge grants are excluded from these totals. Funding is from the National Endowment for the Arts, National Endowment for the Humanities, National Museum Act, and National Science Foundation.

Source: Association of Science-Technology Centers, *ASTC Science Museum Funding Study*, pp. 1-3, and unpublished data.

17

Chapter II
PARTICIPATION

INTRODUCTION

This chapter presents data on how many and what kinds of people participate in science education and what form that participation takes. The data are grouped into three categories: K-12, higher education, and informal education.

HIGHLIGHTS

K-12

1. In high school nearly equal proportions of males and females take mathematics courses. (Chart II-1)
2. A substantially larger percent of white 17-year-olds than black 17-year-olds have taken algebra I, algebra II, and geometry. (Chart II-2)
3. Most college-bound high school students continue to take the standard course preparation including 3+ years of mathematics and 2+ years of science. (Chart II-3)
4. Honors courses in mathematics and English enrolled higher percents (both 14.5) of students than other honors courses. (Chart II-4)
5. More than one-third of all high school mathematics teachers and almost half of all high school science teachers have participated in at least one NSF-sponsored activity. (Chart II-5)

Higher Education

1. Among those declaring a major in the sciences at two-year institutions, engineering accounts for as many students as all the other sciences combined. (Chart II-6)
2. While more undergraduates enroll in engineering than any other science, women and minorities find their greatest representation in the biological sciences. (Chart II-7)
3. Between 1969 and 1976, undergraduate enrollments in the social sciences declined by more than 50%. (Chart II-8)
4. Undergraduate engineering enrollments are rising significantly. (Chart II-9)
5. Between 1960 and 1976, graduate enrollments in the sciences as a percent of total enrollments have declined, once accounting fo 37% of all enrollments, dropping to 23% i 1976. (Chart II-10)
6. At the graduate level in 1978, women accounted for approximately one-third of the enrollments in the biological sciences but for only 7% of those in engineering. (Chart II-11)
7. As a percentage of total enrollment at the graduate level, women have increased thei share in every science since 1969. (Chart II-12)
8. Approximately 30,000 scientists and engineers enrolled in continuing education credit-granting courses in 1975-76. (Chart II-13)
9. Almost 187,000 scientists and engineers enrolled in continuing education non-credit activities during 1975-76. (Chart II-14)

Informal Education

1. On the average, a higher percent of 13-year-olds than 17-year-olds report participating i science-related activities outside of school (Chart III-15)
2. There has been an increase in the total number of people attending museums belongin to the Association of Science/ Technology Centers (ASTC) between 1975 and 1977 (Charts II-16, A&B)
3. TV is the most frequently reported source o information about energy issues, but th print media is the most frequently reporte source of information about new developments in energy science and technology (Chart II-19)

Chart II-1: Percent of 17-year-olds who had taken various mathematics courses, by sex, 1977-78

The total percent of students taking various mathematics courses declines as the courses become more difficult. The difference in percents of males and females range from 1.1 to 3.6.

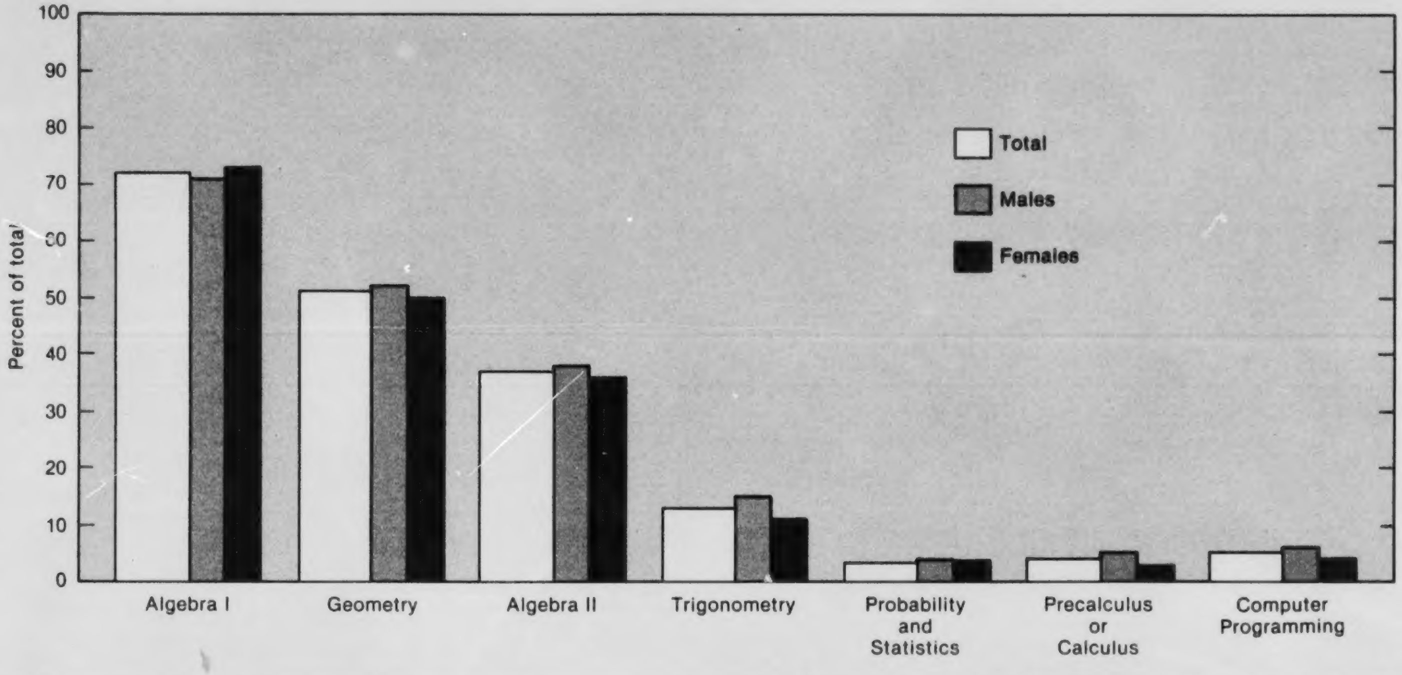


Table II-1: Percent of 17-year-olds who had taken various mathematics courses*, by sex, 1977-78

	Algebra I	Geometry	Algebra II	Trigonometry	Probability & Statistics	Precalculus or Calculus	Computer Programming
Total	72.1	51.3	36.9	12.9	2.7	3.9	5.0
Males	70.7	52.1	37.8	14.7	3.3	4.7	5.9
Females	73.6	50.5	36.1	11.1	2.2	3.1	4.1

*The data are self-reported by the 17-year-olds and courses were ½ or 1 year in length.

Source: National Assessment of Educational Progress, *Mathematical Knowledge and Skills*, pp. 45, 51, and unpublished data.

Chart II-2: Percent of 17-year-olds who had taken various mathematics courses, by race, 1977-78

A substantially larger percent of white 17-year-olds than black 17-year-olds have taken algebra I &
and geometry.

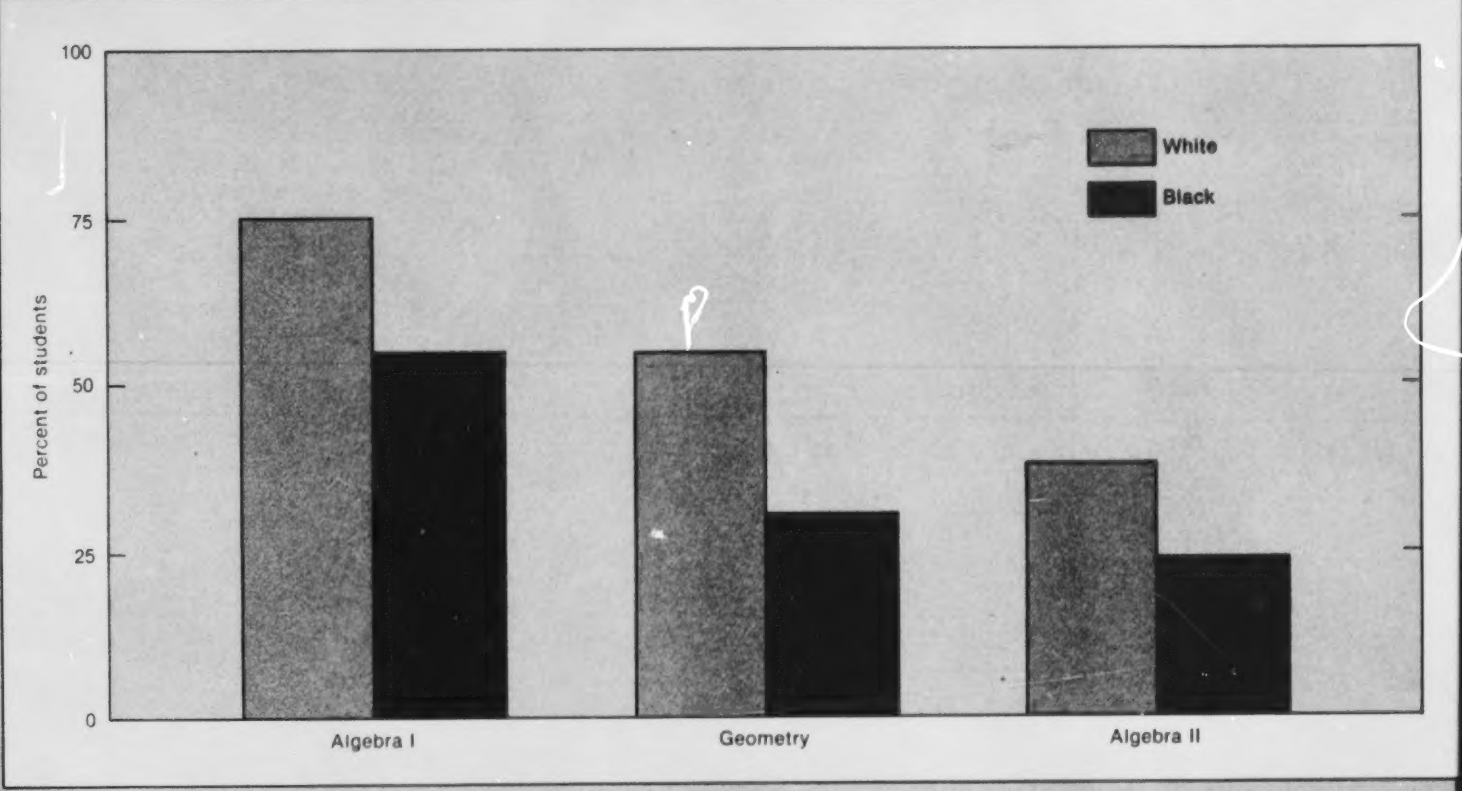


Table II-2: Percent of 17-year-olds who had taken various mathematics courses, by race, 1977-78

	Algebra I	Geometry	Algebra II
Black	55	31	24
White	75	55	39

Source: National Assessment of Educational Progress, *Mathematical Knowledge and Skills*, p. 45.

Chart II-3: Mean number of years of study, by subject of college-bound seniors, by sex, 1978-1979

College-bound seniors continue to show the standard course preparation: 4 years of English, 3+ o mathematics, 2 of a foreign language, 1+ of biology, 1-2 of a physical sciences, and 3+ of socia studies. The greatest inter-sex differences appear in the physical sciences and mathematics where th males take more course work.

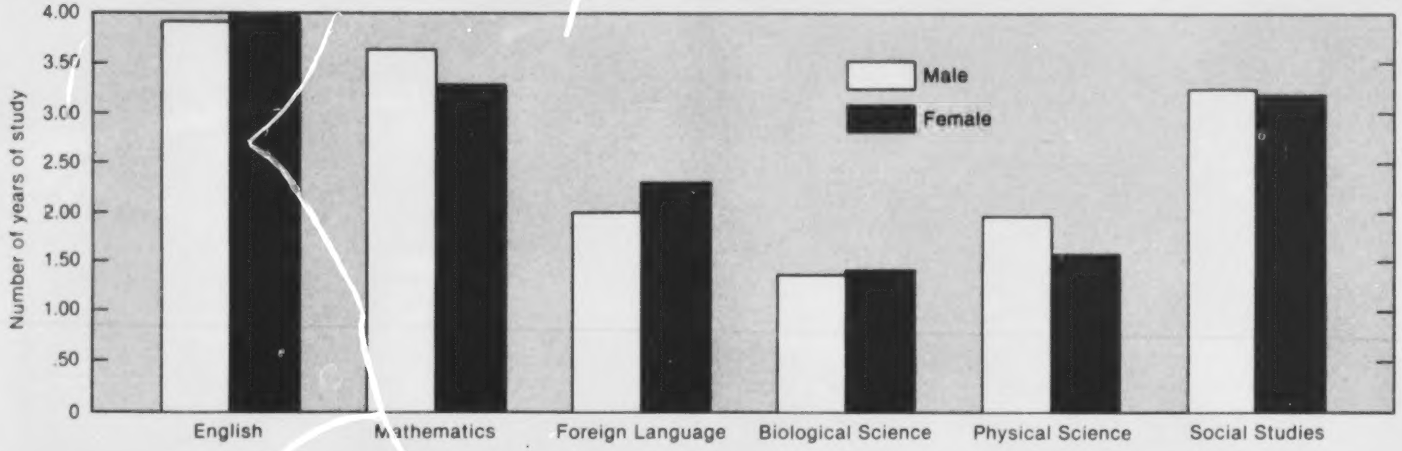


Table II-3: Number of years of study by subject of college-bound seniors, by sex, 1978-79

	English		Mathematics		For. Languages		Bio. Sciences*		Phy. Sciences*		Soc. Studies*	
	Male %	Female %	Male %	Female %	Male %	Female %	Male %	Female %	Male %	Female %	Male %	Female %
No Courses	0.3	0.2	0.4	0.5	15.7	11.0	5.9	4.5	6.6	12.1	0.7	0.7
One Year	1.2	1.0	1.7	3.0	14.0	12.8	60.9	60.4	26.8	38.8	2.3	2.4
Two Years	1.7	1.2	9.3	16.9	38.0	34.7	25.4	27.7	36.4	33.5	16.7	18.6
Three Years	7.0	6.5	24.1	34.2	18.9	21.5	5.2	5.2	23.7	12.9	38.8	41.3
Four Years	80.5	79.5	52.6	39.0	10.6	15.2	1.9	1.5	4.9	2.0	35.2	31.4
Five or More Yrs.	9.2	11.7	11.9	6.4	2.8	4.8	0.8	0.6	1.7	0.6	6.2	5.7
No. Responding .	440075	490337	439862	490020	436541	487481	437965	488242	437104	486037	437379	487398
Mean No. Yrs. . . .	3.94	3.99	3.62	3.27	2.03	2.32	1.39	1.41	1.98	1.56	3.24	3.17
Mean No. (Total) .	3.97		3.44		2.18		1.40		1.76		3.21	

*Students were given examples of science and social studies courses as follows: biological sciences — "biology, botany, and zoology," physical sciences — "chemistry, physics, and earth sciences," social studies — "history, government, and geography." It is not clear where, if at all, students would note course-taking in physical or general science, anthropology, economics, sociology, or psychology.

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors, 1979*, p. 14.

Chart II-4: Percent of college-bound seniors who took an honors course, by subject, 1978-79

The percentage of students taking honors courses from among those who reported subject courses on the Student Descriptive Questionnaire of the Admissions Testing Program included 8.8% for social studies and 14.5% for mathematics.

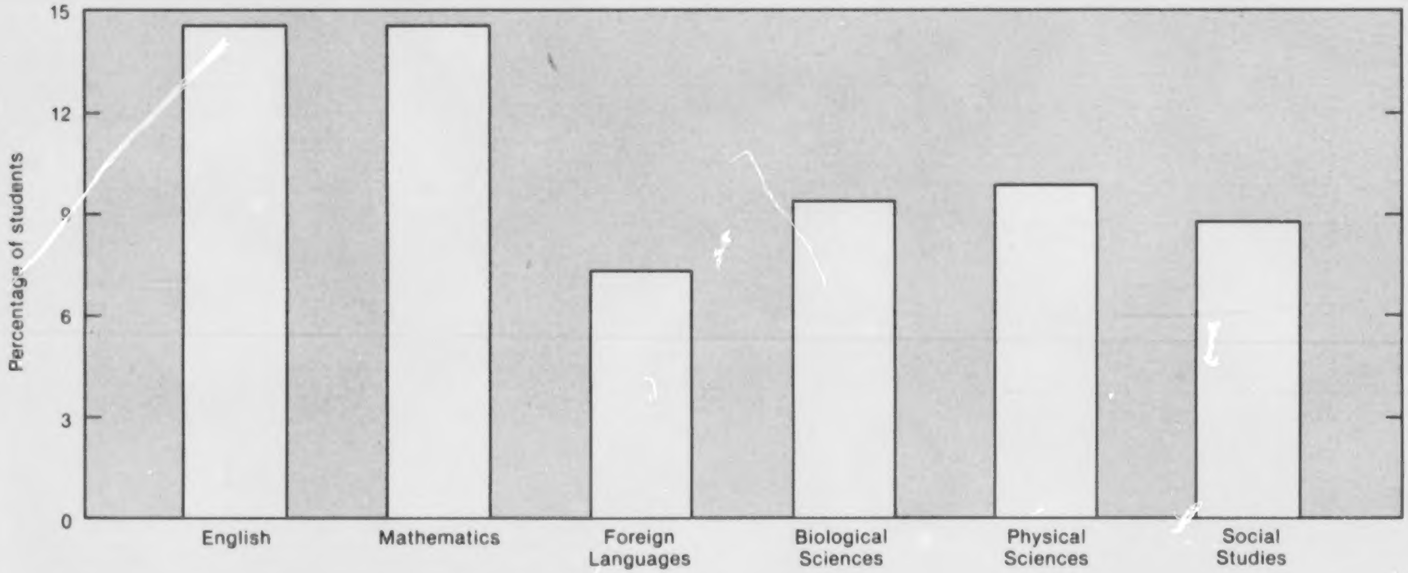


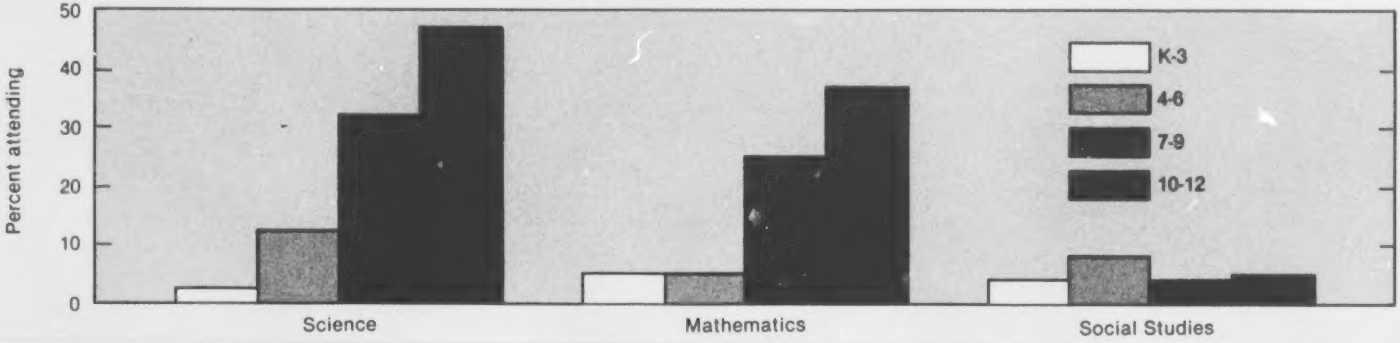
Table II-4: Number and percent of college-bound seniors who took an honors course, by subject, 1978-79

Honors Courses:	English	Mathematics	Foreign Languages	Biological Sciences	Physical Sciences	Social Studies
Number Who Took an Honors Course, by Subject	134,158	133,778	59,631	83,162	81,133	80,548
Number Who Took a Regular Course, by Subject	790,087	789,665	753,404	799,858	747,996	839,305
Total	924,245	923,443	813,035	883,020	829,129	919,853
Percent Who Took Honors Courses	14.5	14.5	7.3	9.4	9.8	8.8

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors, 1979*, p. 21.

Chart II-5: Percent of current teachers who have attended an NSF-sponsored institute, workshop, or conference

Participation by teachers in NSF-sponsored activities increases with grade level. More than one-third of all high school mathematics teachers and almost half of all high school science teachers have participated in at least one such activity. Mathematics and science teachers, especially at the higher grade levels, are much more likely to have participated than social studies teachers.



Source: Weiss, Iris R., *et al*, *The Status of Pre-College Science, Mathematics, and Social Studies Educational Practices in U.S. Schools: An Overview and Summaries of Three Studies*, p. 6. (Highlights Report)

Table II-5: Percent of educators attending one or more NSF-sponsored institutes, workshops or conferences

	Yes	No	Missing Or Inconsistent Response[1]
State Supervisors			
Mathematics (N = 50)	77	21	2
Science (N = 61)	79	15	6
Social Studies (N = 62)	60	35	5
K-6 District Program Q. Respondents			
Mathematics (N = 327)	18	63	19
Science (N = 326)	28	54	18
Social Studies (N = 303)	16	66	18
7-12 District Program Q. Respondents			
Mathematics (N = 321)	39	54	8
Science (N = 318)	46	48	6
Social Studies (N = 298)	21	71	8
Principals			
K-3 (N = 317)	10	85	5
4-6 (N = 292)	11	83	7
7-9 (N = 298)	13	81	6
10-12 (N = 270)	25	71	4

	Yes	No	Missing or Inconsistent Response[1]
K-3 Teachers			
Mathematics (N = 297)	5	87	9
Science (N = 287)	2	91	8
Social Studies (N = 254)	4	87	9
4-6 Teachers			
Mathematics (N = 277)	5	85	10
Science (N = 271)	12	80	7
Social Studies (N = 281)	8	88	4
7-9 Teachers			
Mathematics (N = 550)	25	67	8
Science (N = 535)	32	63	4
Social Studies (N = 453)	4	90	6
10-12 Teachers			
Mathematics (N = 548)	37	60	3
Science (N = 586)	47	44	9
Social Studies (N = 490)	5	84	10

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[1] Includes persons who indicated they had attended one or more NSF-sponsored activities but then failed to circle the ones attended and those who said they had not attended any and then circled one or more.

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 69.

Chart II-6: Enrollments in two-year colleges, by sex and by field, fall 1978

Less than 4% of two-year institution students declare a major in agriculture/natural resource biological sciences, engineering, or physical sciences. Within the 4%, women in two-year institution exhibit the same pattern as those in four-year institutions and graduate school. They are most concen trated in the biological sciences, over 50% of the total, and least represented in engineering, abou 11% of the total.

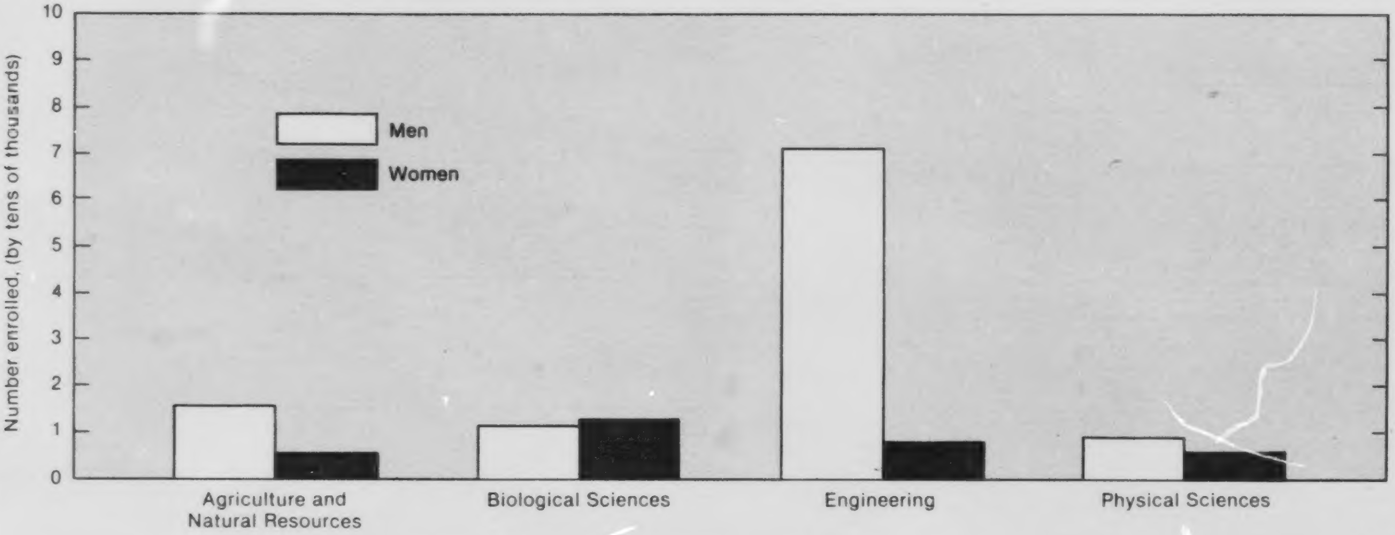


Table II-6: Enrollments in two-year colleges, by sex, and by field, fall 1978

Field	Male	Female
Agriculture and Natural Resources . .	15,238	5,236
Biological Sciences	10,716	12,086
Engineering	70,210	7,969
Physical Sciences	9,303	5,963
All Others	1,795,421	2,133,015
Total by sex	1,900,888	2,164,269
Total Enrollment	4,065,157	

Source: Pepin, Andrew J., *Fall Enrollment in Higher Education, 1978, (to be published).*

Chart II-7: Undergraduate enrollments of women and minorities, by field, fall 1978

About 50% of all undergraduates in 1978 were women. About 46% of the undergraduates enrolled in biology were women but only about 11% of the engineering enrollees were women.

Minorities constituted about 18% of total enrollment. Their science enrollments ranged from 6% in agriculture and natural resources to 17% in biological sciences.

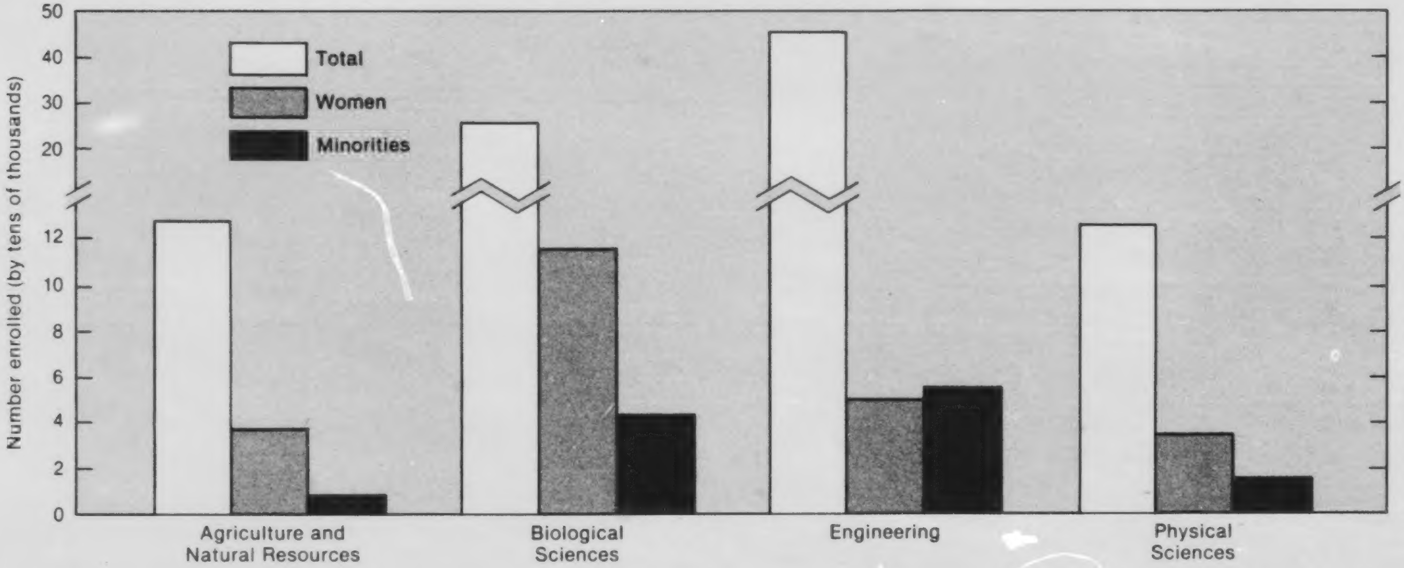


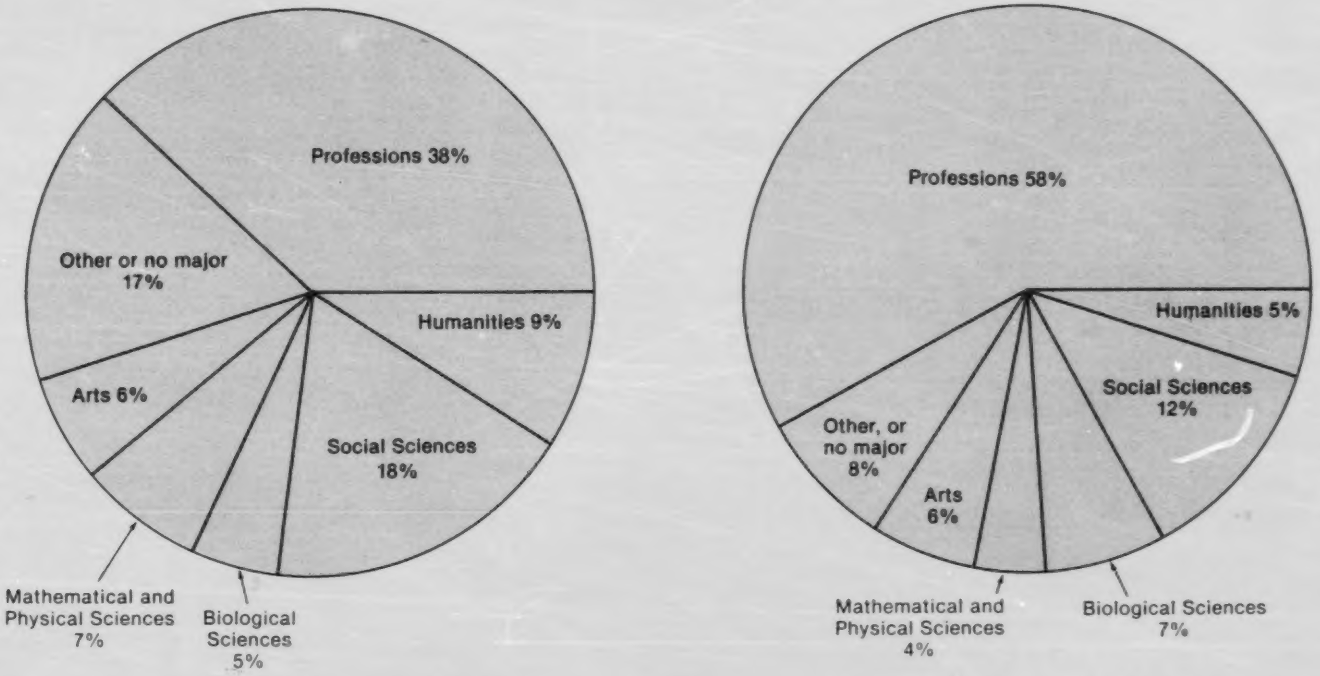
Table II-7: Undergraduate enrollments of women and minorities, by field, fall 1978

Field	Total Enrollment	Women Number	Women Percent	Minorities Number	Minorities Percent
Agriculture and Natural Resources . . .	127,605	38,753	30	7,868	6
Biological Sciences	252,777	115,038	46	42,378	17
Engineering	451,160	49,742	11	53,809	12
Physical Sciences	123,986	32,720	26	12,811	10
All fields	8,698,694	4,375,715	50	1,589,466	18

Source: Pepin, Andrew J., *Fall Enrollment in Higher Education, 1978* (to be published).

Chart II-8: Percentages of undergraduate enrollments by field, 1969 and 1976

Although enrollment in biological sciences increased somewhat, mathematical, physical, and social sciences lost substantial portions of their enrollments. Professional subjects such as journalism gained considerable enrollments. Most of these changes were paralleled by faculty changes (Chart I-12).



Undergraduate Enrollment 1969 **Undergraduate Enrollment 1976**

Source: Carnegie Foundation for the Advancement of Teaching, *Missions of the College Curriculum*, p. 103 (revised per advice of Carnegie Foundation).

Chart II-9: Total engineering enrollments in engineering schools, 1968-1978

Undergraduate engineering enrollments are rising significantly.

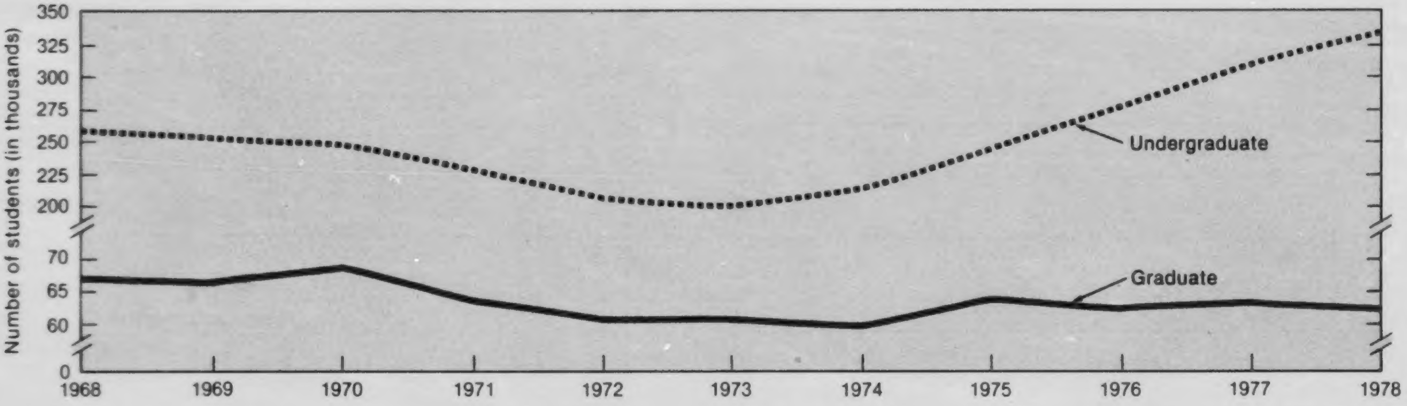


Table II-9: Total engineering enrollments in engineering schools*, 1968-1978

Engineering Students	Fall 1968	Fall 1969	Fall 1970	Fall 1971	Fall 1972	Fall 1973	Fall 1974	Fall 1975	Fall 1976	Fall 1977	Fall 1978
Freshman Year, Full-Time	77,484	74,113	71,661	58,566	52,100	51,925	63,444	75,343	82,250	88,780	95,805
Sophomore Year, Full-Time	55,615	52,972	53,419	47,948	42,272	40,519	45,935	55,891	63,003	70,326	72,150
Junior Year, Full-Time	50,274	50,039	49,855	48,543	45,874	41,673	43,007	49,338	56,835	64,271	69,816
Senior Year, Full-Time	50,736	51,738	51,983	51,377	49,895	48,366	44,538	47,070	51,692	60,119	68,260
Fifth Year, Full-Time	5,133	4,668	4,812	4,391	4,586	4,222	4,175	3,737	4,055	5,312	5,206
TOTAL FULL-TIME UNDERGRADS	239,242	233,530	231,730	210,825	194,727	186,705	201,099	231,379	257,835	289,248	311,237
Part-Time Undergraduates	20,754	20,984	18,445	18,222	14,149	15,692	16,689	17,041	19,844	20,634	22,843
TOTAL UNDERGRADUATE STUDENTS	259,996	254,514	250,175	229,047	208,875	202,397	217,788	248,420	277,679	309,882	334,080
Master's Degree, Full-Time	24,469	20,014	23,216	22,405	22,877	22,588	21,999	26,004	25,516	26,876	26,060
Doctor's Degree, Full-Time	15,768	14,298	14,802	14,100	13,460	11,904	10,628	11,281	10,963	12,359	12,321
TOTAL FULL-TIME GRADUATE STUDENTS	40,237	34,312	38,018	36,505	36,337	34,492	32,627	37,285	36,479	39,235	38,381
Part-time Graduate Students	27,246	32,645	30,802	27,302	24,940	26,114	27,572	27,173	26,842	25,065	24,133
TOTAL GRADUATE STUDENTS	67,483	66,957	68,820	63,807	61,277	60,606	60,199	64,458	63,321	64,300	62,514
Number of Schools	271	269	275	282	283	285	282	291	289	289	276

*Engineering schools enroll about ¾ of all engineering students.

Source: Engineering Manpower Commission of Engineers Joint Council, *Engineering Manpower Bulletin*, May 1979, p. 2.

Chart II-10: Enrollment for master's and doctor's degrees, by field, fall 1960-fall 1976

As a group the six fields represented here accounted for 37% of all enrollments in 1960, 31% in 1970, and 23% in 1976. In general the numbers of enrollments increased from 1960 to 1970. Since then enrollments in mathematics, engineering, and social sciences have declined.

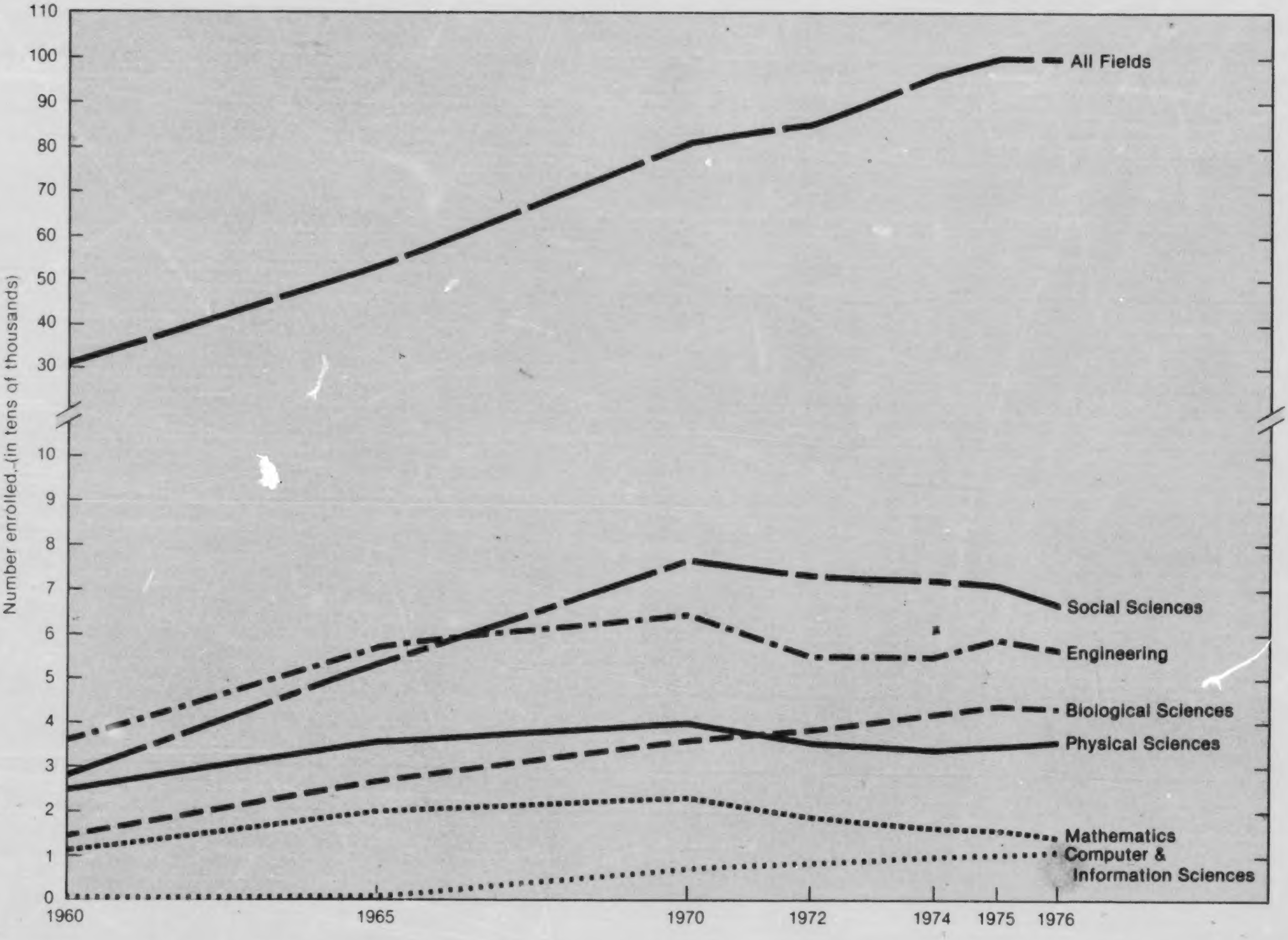


Table II-10: Enrollment for master's and doctor's degrees, by field, fall 1960 to fall 1976

Field of study 1	1960 2	1965 3	1970 4	1972 5	1974 6	1975 7	1976 8
All fields	314,349	535,332	816,207	858,580	965,000	1,053,769	1,030,007
Agriculture and natural resources	5,493	8,039	10,432	11,322	12,601	14,674	15,206
Architecture and environmental design	585	1,085	5,433	7,240	9,208	10,231	10,128
Area studies	669	1,412	2,262	4,016	4,198	4,165	4,091
Biological sciences	14,775	27,165	36,499	38,914	42,518	44,157	43,957
Business and management	25,342	50,920	87,487	98,762	123,387	144,953	149,976
Communications	868	1,190	2,503	6,153	8,108	9,315	8,791
Computer and information sciences	([1])	816	7,937	8,826	10,379	10,856	11,852
Education	94,993	150,300	257,605	275,053	327,113	349,087	324,475
Engineering	36,636	57,516	64,788	56,006	56,037	59,402	57,330
Fine and applied arts	6,287	12,539	19,858	24,890	28,016	30,708	30,222
Foreign languages	5,903	13,001	18,567	16,796	14,618	13,891	12,808
Health professions	5,842	8,909	14,242	23,692	30,378	35,463	38,101
Home economics	1,580	2,358	4,611	5,336	6,693	7,664	8,085
Law	1,651	2,465	2,533	2,870	3,493	3,604	3,586
Letters	18,228	35,214	51,167	49,382	48,132	46,464	43,982
Library science	1,360	8,567	12,416	13,554	14,395	14,731	13,307
Mathematics	11,770	20,198	22,672	19,238	16,739	16,168	14,926
Physical sciences	25,707	36,506	40,113	36,047	34,936	35,497	36,147
Psychology	10,677	15,551	25,342	29,157	32,794	35,318	35,363
Public affairs and services	8,235	13,465	19,671	28,272	40,588	47,711	53,032
Social sciences	28,373	53,284	76,805	73,207	72,505	71,213	67,128
Theology	5,314	7,028	7,194	10,334	12,558	15,222	16,791
Interdisciplinary studies	4,061	7,804	26,070	19,513	15,606	33,275	30,723

[1] Data not available.

NOTE.—Data for 1960 exclude students enrolled for first-professional degrees, including some master's degrees in such fields as business and commerce, education, library science, and social work. Data for subsequent years include all students enrolled for master's and doctor's degrees.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1978*, p. 98.

Chart II-11: Graduate enrollments of women and minorities, by field, fall 1978

About 46% of all graduate students are women. Women's graduate enrollments are similar to women's undergraduate enrollments: high in biology (35%) and low in engineering (7%). About 10% of all graduate students are minorities. They comprise 5 to 8% of the enrollments in the fields shown.

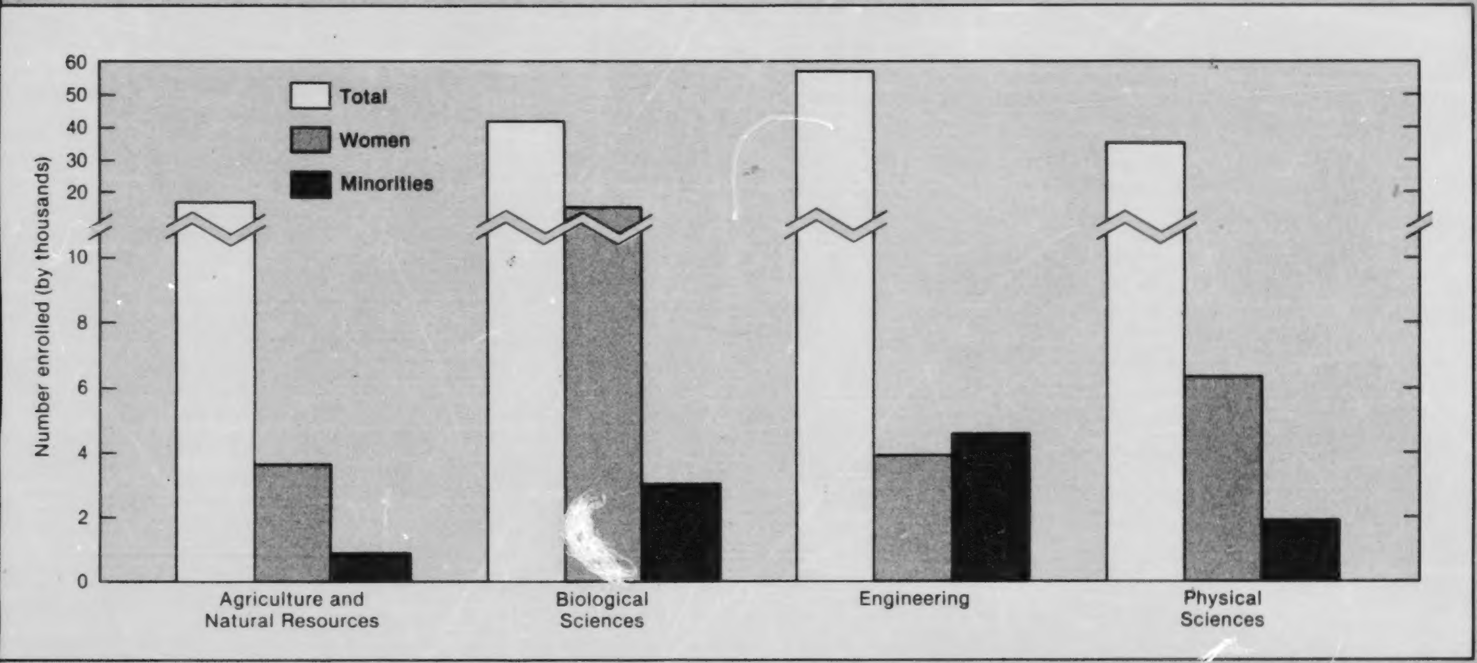


Table II-11: Graduate enrollments of women and minorities, by field, fall 1978

Field	Total Enrollment	Women		Minorities	
		number	percent	number	percent
Agriculture and Natural Resources	16,923	3,613	21	844	5
Biological Sciences	41,785	14,776	35	3,015	7
Engineering	57,123	3,984	7	4,523	8
Physical Sciences	35,279	6,247	18	1,944	6
All Fields	1,076,795	498,995	46	111,625	10

Source: Pepin, Andrew J., *Fall Enrollment in Higher Education* 1978 (to be published).

Chart II-12: Trends in women's enrollment for master's & doctor's degrees, by field, 1969, 1972, 1976.

As a percentage of total enrollment, women show an increase in every field between 1969 and 1976.

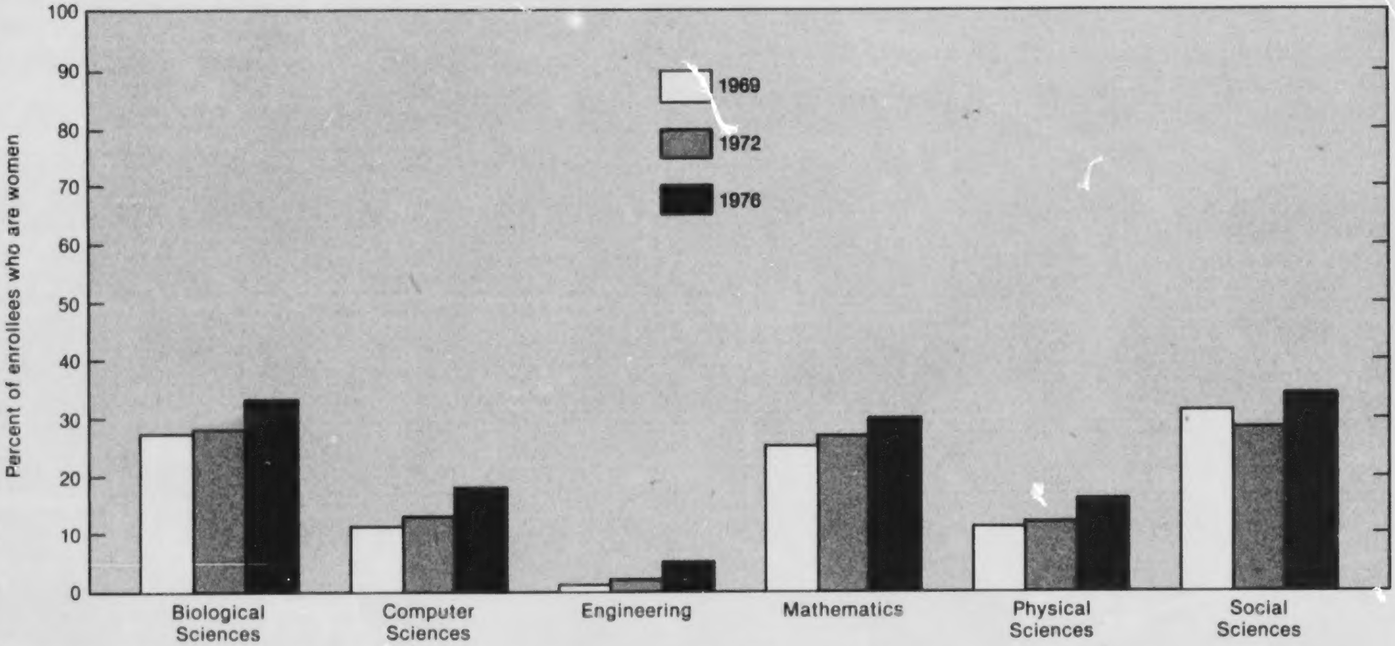


Table II-12: Trends in women's enrollment for master's and doctor's degrees, by field, 1969, 1972, 1976

	1969			1972			1976		
	Total	Women	%W	Total	Women	%W	Total	Women	%W
All Fields	756,865	264,266	35	858,580	326,675	38	1,030,007	451,594	43.8
Agriculture	6,908	476	7	11,322	942	8	15,206[2]	2,592[2]	17.0
Architecture	1,948	240	12	7,240	1,466	20	10,128[3]	2,774[3]	27.4
Biological Sciences	34,861	9,367	27	38,914	10,784	28	43,957	14,281	32.5
Business & Commerce	76,372	3,798	5	36,213	2,795	8	149,976	27,854	18.6
Computer Science & Systems Analysis	6,201	684	11	8,826	1,164	13	11,852	2,180	18.4
Education	234,042	128,617	55	275,053	159,683	58	324,475	209,129	64.5
Engineering	65,048	796	1	56,006	1,219	2	57,330	2,868	5.0
Fine & Applied Arts	26,614	12,481	47	24,890	11,713	47	30,222	15,995	52.9
Foreign Languages	20,721	11,755	57	16,796	10,029	60	12,808	8,255	64.5
Health Professions	12,564	5,372	43	23,692	12,172	51	38,101	24,534	64.4
Law	2,521	102	4	2,870	259	9	3,586	551	15.4
English Language & Literature	34,569[1]	18,932[1]	55	30,162	17,245	57	43,982	24,082	54.8
Library Science	12,092	9,633	80	12,756	9,969	78	13,307	10,628	79.9
Mathematics	22,974	5,639	25	19,238	5,101	27	14,926	4,442	29.8
Physical Sciences	39,885	4,240	11	36,047	4,374	12	36,147	5,661	15.7
Psychology	22,726	7,827	34	29,157	11,189	38	35,363	16,686	47.2
Social Sciences	90,569	28,274	31	73,207	20,686	28	67,128	22,916	34.1
Theology	10,765	1,799	17	10,334	1,757	17	16,791	3,484	20.7

Includes Journalism.

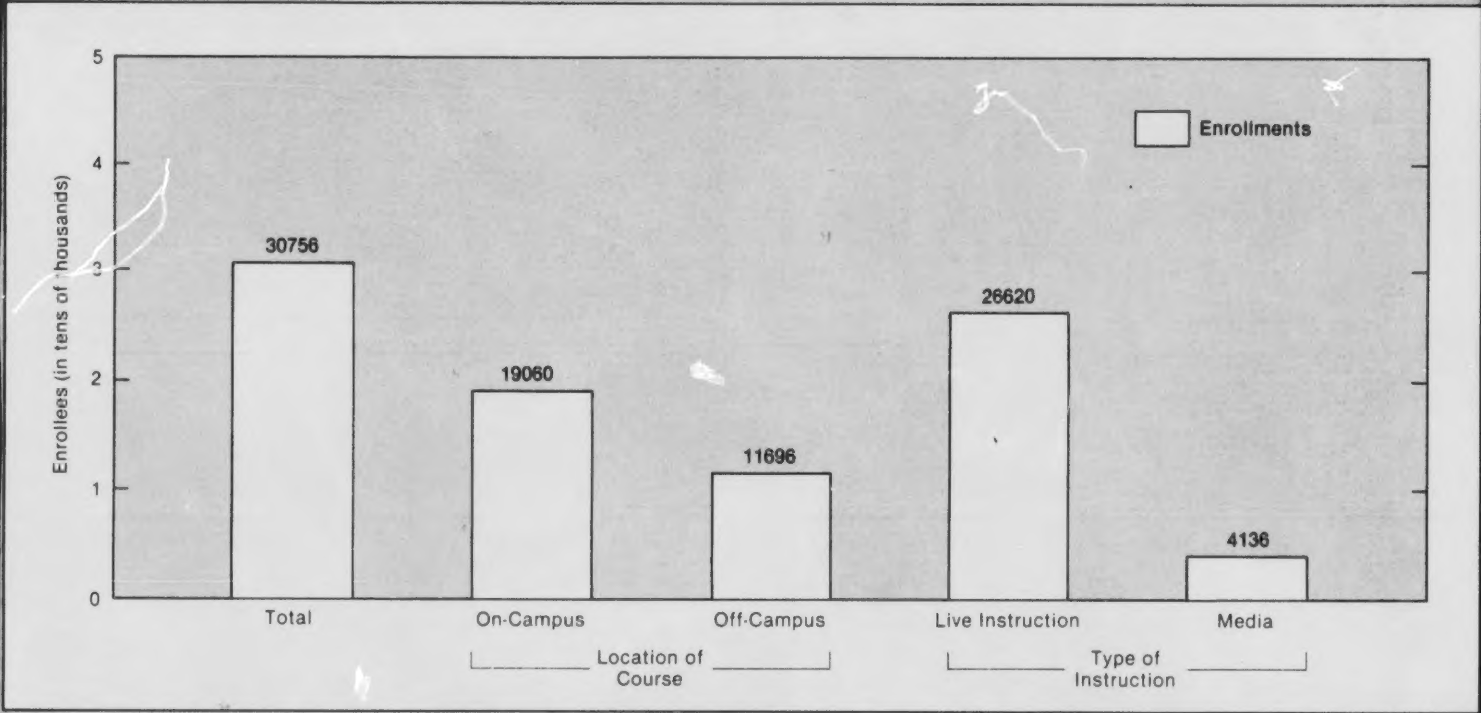
Includes Natural Resources.

Includes Environmental Design.

Source: Vetter, Betty M., *Professional Women and Minorities: A Manpower Data Resource Service*, Second Edition, 1978, p. 13.

Chart II-13: Enrollments in continuing education degree credit courses by scientists and engineers, 1975-76

In 1975-76, over 30,000 scientists and engineers enrolled in degree credit courses offering an average of 3 hours credit. About two-thirds of the enrollments occurred in on-campus courses and one-third off-campus. Comparing this chart with chart I-18, we can see that the average course had an enrollment of approximately nine students. Furthermore, while there were more off-campus activities, attendance was much greater for the on-campus activities.



Source: Klus, John P. and Jones, Judy A., *Survey of Continuing Education Activities for Engineers and Scientists*, pp. 15-17.

Chart II-14: Enrollments in continuing education non-credit activities by scientists and engineers, 1975-76

Almost 187,000 scientists and engineers enrolled in continuing education non-credit activities 1975-76. About 60% of the enrollments took place in university-sponsored activities and 40% with pr fessional societies. Comparing this chart with chart I-19 we can see that while universities offer roughly three times as many activities as the professional associations they attracted only one a one-half times as many enrollees.

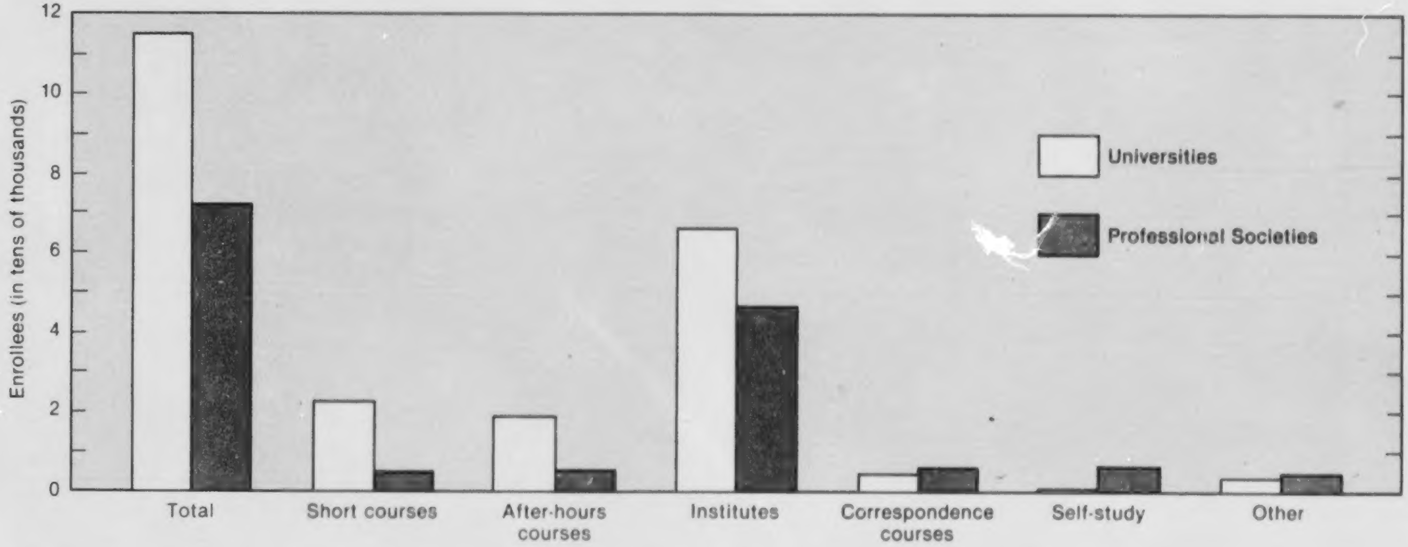


Table II-14: Enrollments in continuing education non-credit activities by scientists and engineers, by type of activity and institution offering activity, 1975-76

Type of Institution	Number with One or More Activities	Total Enrollments	Type of Activity* Short Courses	After-hours Courses	Institutes	Correspondence Courses	Self-study	Other
Universities	92	114,688	22,190	18,705	65,893	4,481	175	3,244
Professional/Technical Organizations	55	71,904	4,918	5,288	46,523	4,583	5,812	4,780
Total	147	186,592	27,108	23,993	112,416	9,064	5,987	8,024

*See Table I-19 for definitions of activities.

Source: Klus, John P. and Jones, Judy A., *Survey of Continuing Education Activities for Engineers and Scientists*, pp. 6-15.

Chart II-15. Percentages of 13- and 17-year-olds participating in various science-related activities outside of science classes

On the average, a higher percent of 13-year-olds than 17-year-olds report participating in scienc related activities outside of school. The activities that 17-year-olds report more frequently than 13-yea olds, however, are reading science articles and watching science shows on TV.

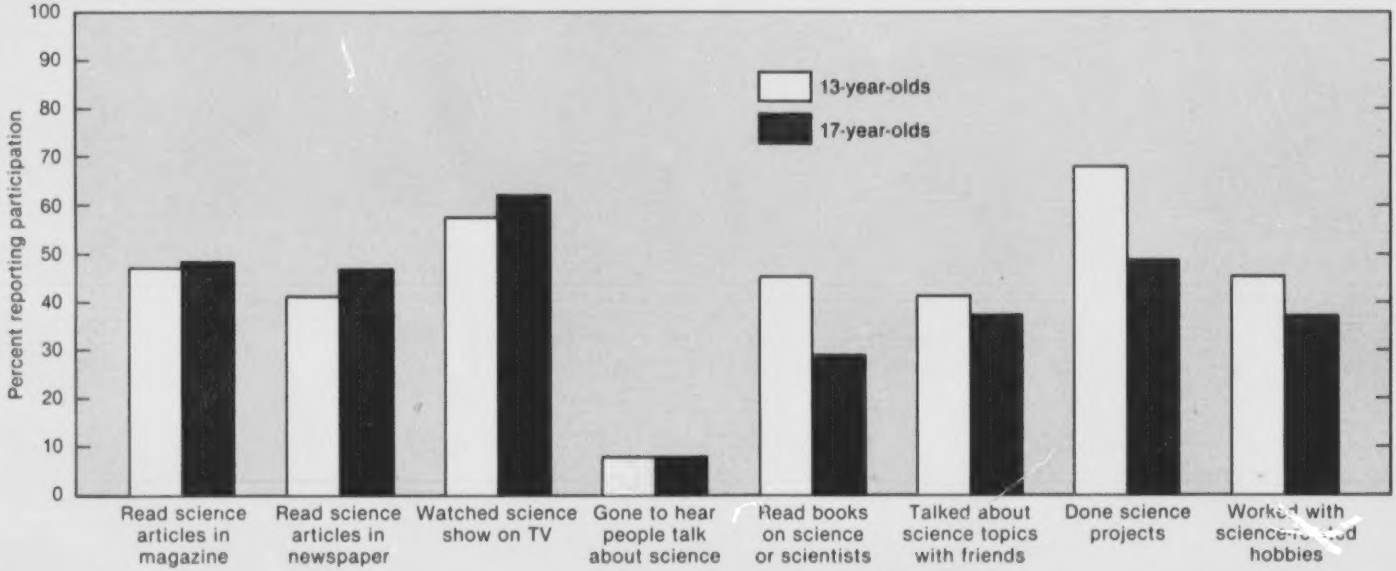


Table II-15: Percentages of 13- and 17-year-olds participating in various science-related activities outside of science classes

How often have you done each of the following activities when *not required* for science class?

	Percent Saying They Often or Sometimes Participate	
	Age 13	Age 17
Read science articles in magazines	47	48
Read science articles in newspapers	41	47
Watched science shows on TV	58	62
Gone to hear people give talks on science	8	8
Read books about science or scientists	45	29
Talked about science topics with your friends	41	37
Done science projects	68	49
Worked with science-related hobbies	45	37
Average percentage reporting participation	44	39

Source: National Assessment of Educational Progress, *Attitudes Toward Science*, p. 9.

Charts II-16, A&B: Attendance at science museums, Association of Science-Technology Centers (ASTC), 1975-77

The Association of Science-Technology Centers (ASTC) reports a general increase in attendance at its members — science museums, and science and technology centers. Forty-nine of its members showed a 13% increase in their combined attendance figures over a three-year period.

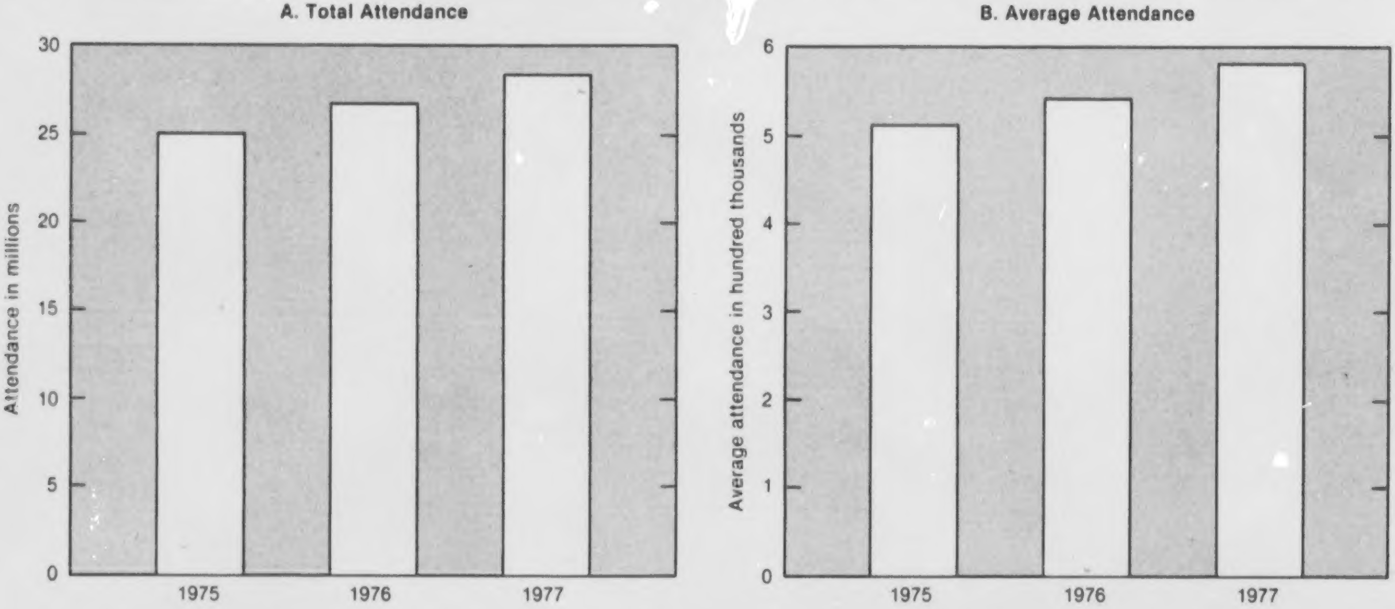


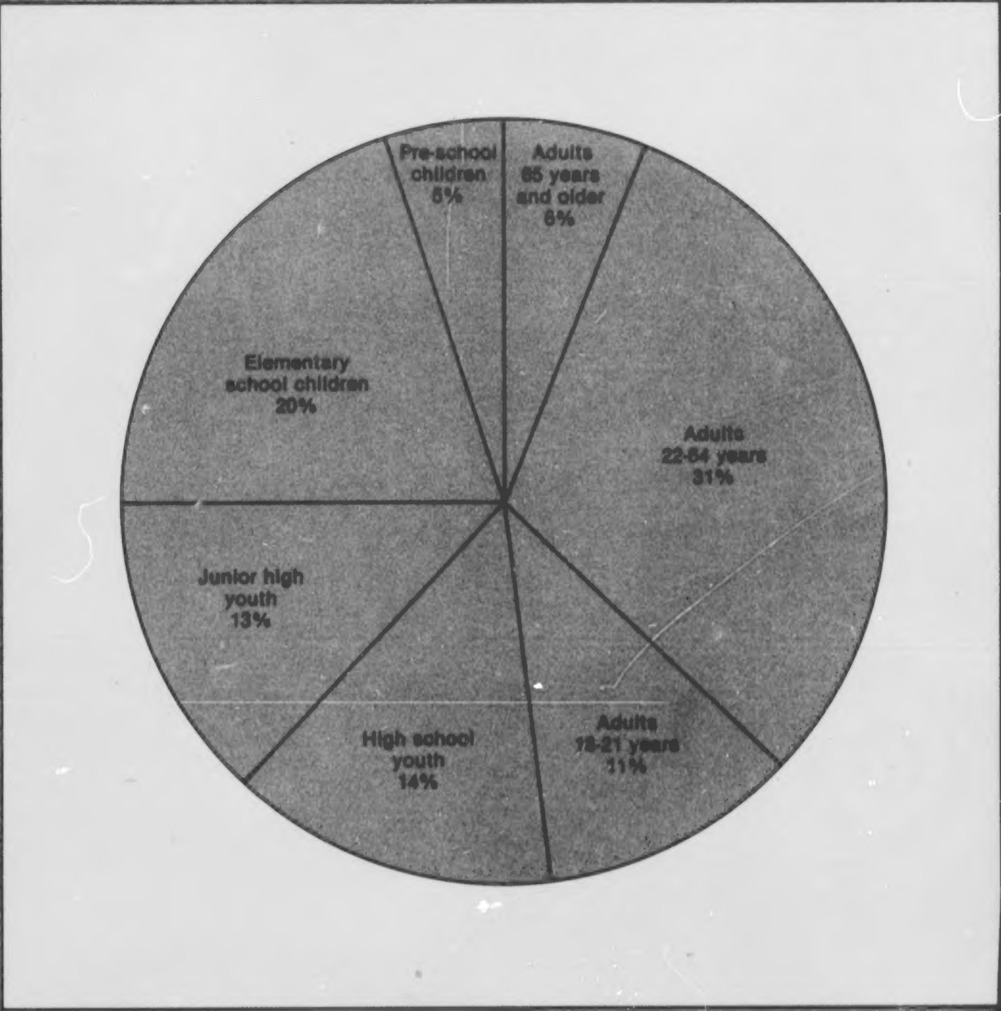
Table II-16: Attendance at science museums, Association of Science-Technology Centers (ASTC). 1975-77

Year	Combined Attendance	Average Attendance
1975	25,010,114	510,410
1976	26,556,428	541,967
1977	28,292,803	577,404
N = 49		

Source: Association of Science-Technology Centers, unpublished data.

Chart II-17: Science museum attendance by age, as percent of total

Science museum attendance is about equally divided between adults and children



Source: Association of Science-Technology Centers, 1977-78 member survey, unpublished data.

Chart II-18: Circulations of popular science magazines

Although there have been slight fluctuations, circulation for all five science magazines has increased i the past decade.

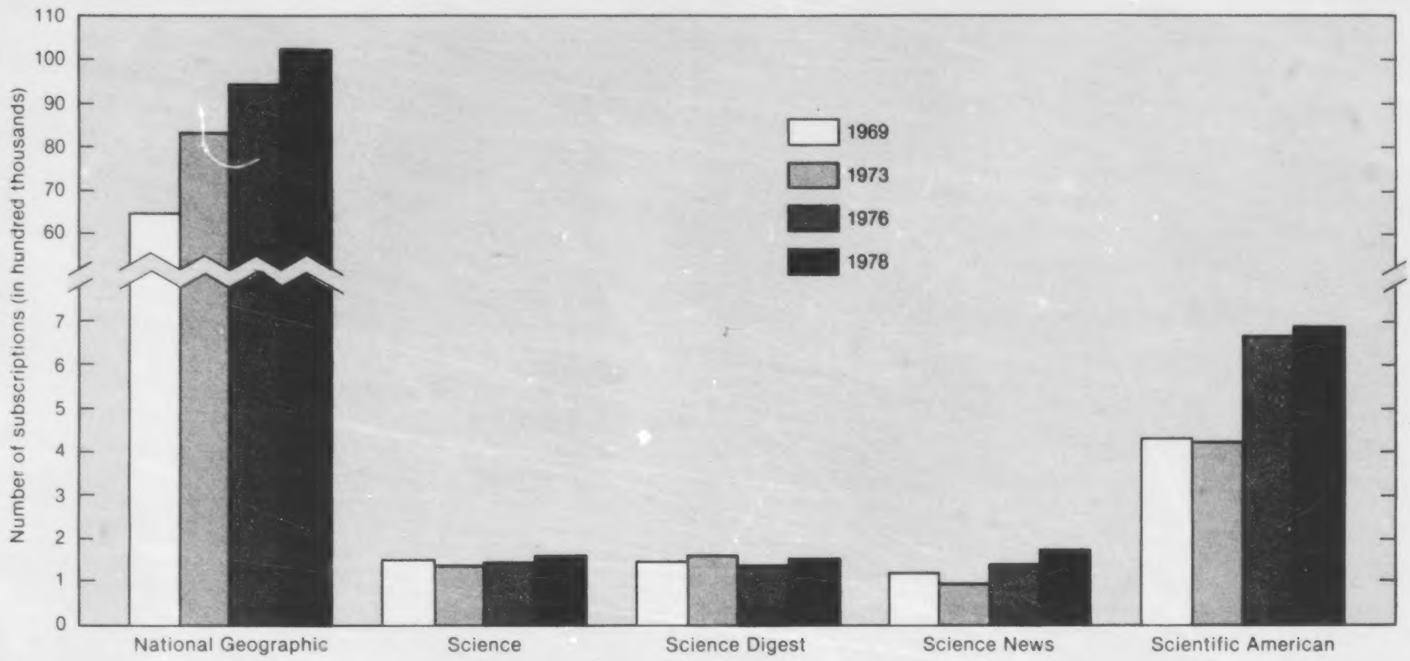


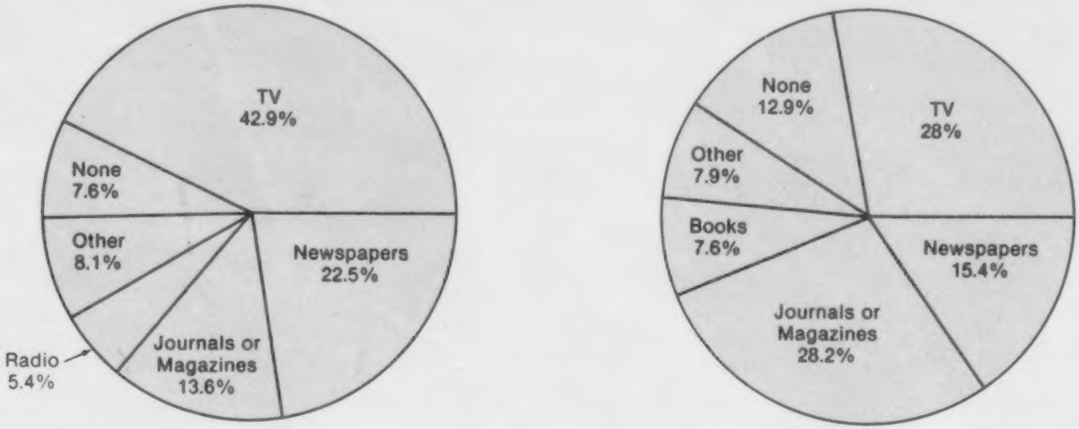
Table II-18: Circulations of popular science magazines

Magazine	1969	1973	1976	1979 (June)
National Geographic	6,402,674	8,276,668	9,350,123	10,249,748
Science	146,898	139,785	142,635	151,488
Science Digest	147,000	156,000	144,000	153,000
Science News	113,927	94,923	134,283	168,248
Scientific American	427,653	425,000	665,395	691,922

Sources: Circulation departments of each magazine.

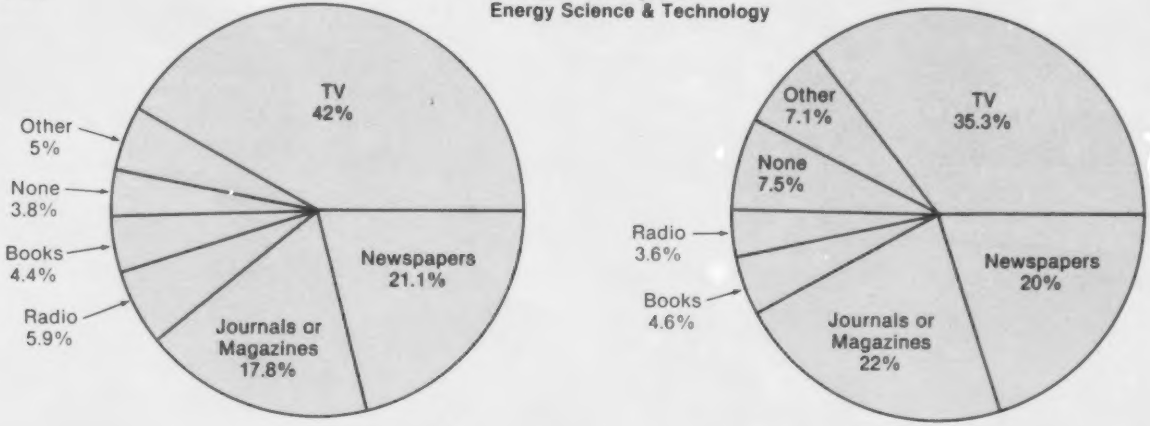
Chart II-19: Sources used by young adults[1] to obtain information about selected energy issues

TV is the most frequently reported source of information about energy issues. For information about pollution, conservation, and alternative energy sources, TV provides information to nearly as many young adults as all the print media combined. For new developments in energy science and technology, however, young adults tend to use the print media.



Pollution

New Developments in Energy Science & Technology



Energy Conservation

Alternative Energy Sources

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[1] Defined as 26-35 years old.

Source: National Assessment of Educational Progress, *Energy Knowledge and Attitudes: A National Assessment of Energy Awareness Among Young Adults*, p. 38.

Chapter III

ATTITUDES, GOALS, AND NEEDS

INTRODUCTION

Resources and participation determine the form and content of American education. But knowing only that gives us an incomplete picture of our educational system, since that alone does not tell us how people feel about the system, what their educational aspirations are, or in what areas they feel the system needs improvement. Such data, generally termed affective, are crucial if we are to understand why our educational system is the way it is and which changes are most likely to occur.

Obtaining affective information regarding science education exclusively (as opposed to just science or education) is very difficult. National polls historically neglect to ask about attitudes towards science education. Nevertheless, this chapter assembles a collection of data regarding science education grouped according to three categories of belief holders (students, faculty, public), which is reasonably representative of people's attitudes, goals, and needs concerning science education.

HIGHLIGHTS

Students

1. The popularity of science and social studies increases somewhat with students' ages, while the popularity of mathematics decreases. Even so, mathematics is more popular at all ages than either science or social studies. (Chart III-1)
2. About 32% of college-bound seniors report intentions to study science, engineering, mathematics, or social sciences in college. (Chart III-2)
3. In the basic skills area, more college-bound seniors say they need help in mathematics than any of the other areas. (Chart III-3)
4. The college-bound seniors scoring, on the average, highest on their SAT's, tend to plan on studying science, engineering, mathematics, or English literature. (Chart III-4)

Faculty

1. A total of 67% of science, mathematics, and social studies teachers reported needing assistance in obtaining information about instructional materials. (Chart III-5)
2. The availability of lab assistants or paraprofessionals and money to buy supplies on a day to day basis were seen as major need areas for mathematics, science, and social studies teachers. (Chart III-6)
3. Issues related to facilities, equipment, and supplies are significantly more troublesome in science classes than in mathematics or social studies classes. (Chart III-6)
4. The largest problem perceived by mathematics teachers is the lack of materials for individualizing instruction. (Chart III-7)
5. Science teachers perceived three serio problems: inadequate facilities, insufficie funds for purchasing equipment and su plies, and lack of materials for individualizi instruction. (Chart III-8)
6. Social studies teachers perceive themselv as having more problems than mathemati and science teachers, but the severity of t problems does not seem as great. Their mo troublesome problems are inadequate st dent reading abilities and need for individu ized materials. (Chart III-9)
7. Only 22% of elementary school teachers f "very well qualified" to teach science a 16% feel "not well qualified" to teach it. Six percent feel "adequately qualified." (Ch III-10)
8. A sizable number of secondary scho science, mathematics, and social studi teachers feel inadequately qualified to tea one or more of their courses. (Chart III-11)
9. Mathematics and science teachers are nee ed to fill currently unfilled positions and t projection is that they will continue to needed in the next five years. (Charts III-1 A&B)

Public

Ninety-seven percent of the public views math matics as an essential for high school student Eighty-three percent regard science as essenti (Chart III-13)

Chart III-1: Percentages of students naming various subjects in school as their most favorite, ages 9, 13, and 17.

The popularity of science and social studies, never very high among students, increases somewhat as students age. Mathematics, by contrast, is the favorite of nearly half the 9-year-olds yet becomes less popular as students age. It is, even so, the favorite of more 13- and 17-year-olds than either science or social studies.

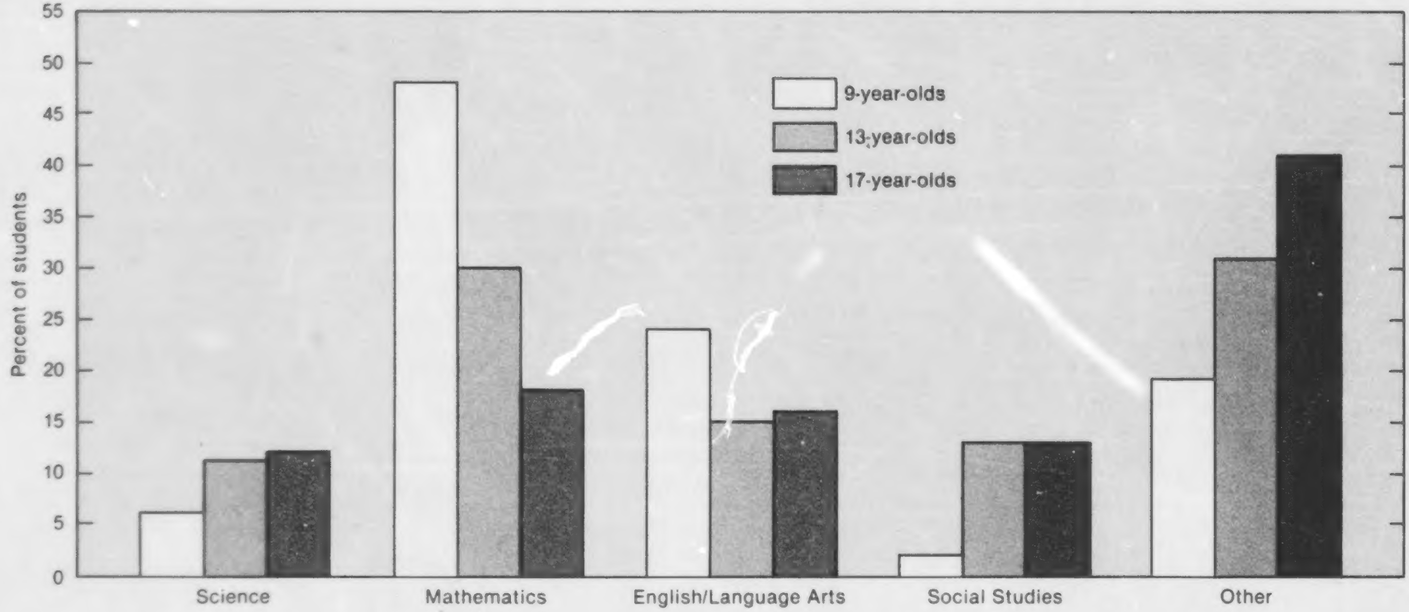

Table III-1: Percentages of students naming various subjects in school as their most favorite, ages 9, 13 and 17

	Percent Naming Favorite Subject		
	Age 9	Age 13	Age 17
Science	6	11	12
Mathematics	48	30	18
English/language arts	24	15	16
Social studies	3	13	13
Other	19	31	41

Source: National Assessment of Educational Progress, *Attitudes Toward Science*, p. 5.

Chart III-2: Percent of college-bound seniors intending to study science, engineering, mathematics or social sciences, by sex, 1979

About 32% of college-bound seniors said that they intended, as a first choice, to study science, engineering, mathematics, or social science. The greatest differences between the sexes were in psychology and engineering.

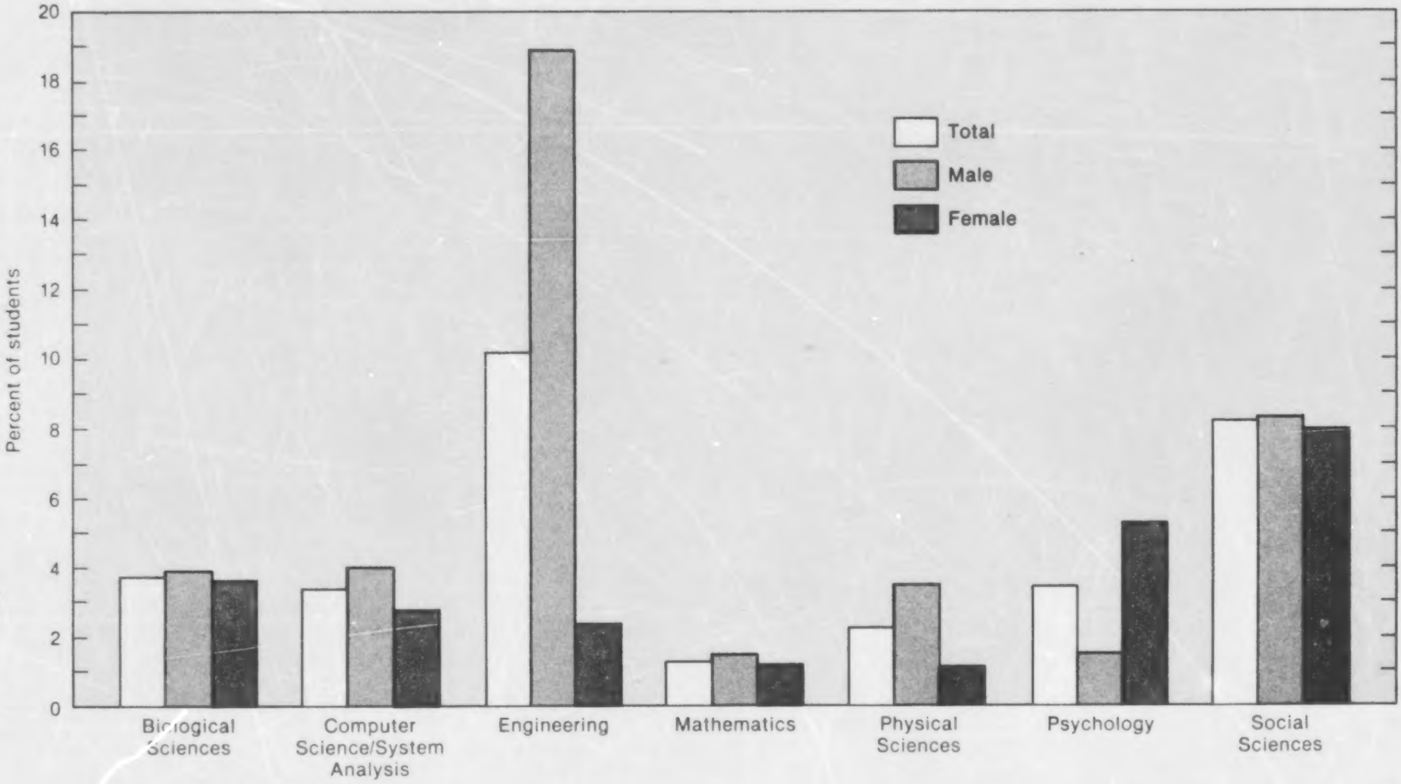

Table III-2: Percent of college-bound seniors intending to study various fields, by sex, 1979

Number Responding	Male 430,446	Female 482,450	Total 912,896
	Male %	Female %	Total %
Arts and Humanities	10.1	15.0	12.7
Architecture/Environmental Design	3.1	0.8	1.8
Art	2.3	6.2	4.4
English/Literature	1.0	2.2	1.6
Foreign Languages	0.3	1.5	1.0
Music	20	2.0	2.0
Philosophy and Religion	0.6	0.3	0.4
Theater Arts	0.9	2.0	1.5
Biological Sciences and Related Areas	17.7	26.0	22.1
Agriculture	2.4	1.2	1.7
Biological Sciences	3.9	3.6	3.7
Forestry/Conservation	1.8	0.6	1.1
Health and Medical	9.7	20.7	15.5
Business, Commerce, and Communications	21.6	20.9	21.2
Business and Commerce	18.2	17.3	17.8
Communications	3.4	3.5	3.5
Physical Sciences and Related Areas	27.8	7.2	16.9
Computer Science/Systems Analysis	4.0	2.7	3.3
Engineering	18.9	2.3	10.1
Mathematics	1.4	1.1	1.2
Physical Sciences	3.5	1.1	2.2
Social Sciences and Related Areas	15.4	24.6	20.3
Education	3.1	9.5	6.5
Ethnic Studies	0.0	0.0	0.0
Geography	0.1	0.0	0.0
History and Cultures	0.8	0.5	0.7
Home Economics	0.1	1.2	0.7
Library Science	0.0	0.1	0.1
Military Science	1.4	0.1	0.7
Psychology	1.5	5.2	3.4
Social Sciences	8.3	8.0	8.2
Miscellaneous	7.3	6.4	6.8
Other	1.2	1.0	1.1
Trade and Vocational	1.3	1.0	1.1
Undecided	4.9	4.4	4.6

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors, 1979*, p. 18.

Chart III-3: Plans of college-bound seniors to ask colleges for special assistance, by areas of need and ethnic group, 1978-79

In the basic skills, a greater percentage of students felt that they would need help in mathematics than in reading and writing. Furthermore, twice as many black students as white students felt that they would need help in this area.

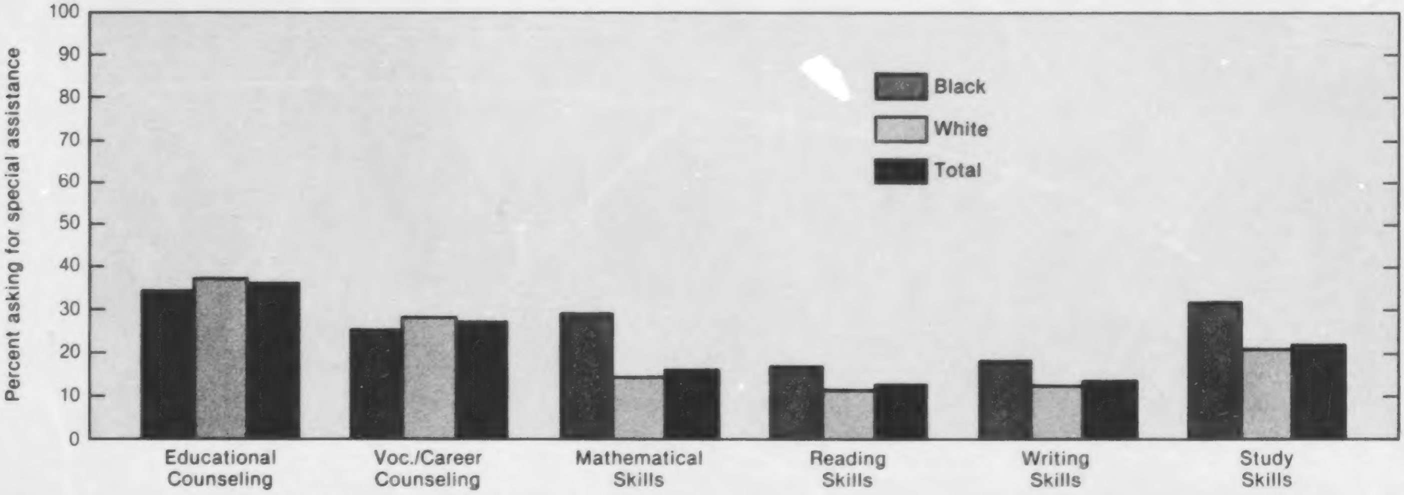

Table III-3: Plans of college-bound seniors to ask college for special assistance, by areas of need and ethnic group, 1978-79

	American Indian %	Black %	Mexican-American %	Oriental %	Puerto Rican %	White %	Other %	Total %
Educational Counseling	36.7	34.4	45.6	44.1	39.1	37.3	37.8	36.7
Voc/Career Counseling	26.5	25.4	32.3	35.6	25.0	28.3	27.8	27.8
Mathematical Skills	22.5	29.5	26.0	18.7	21.9	14.6	20.3	16.3
Reading Skills	14.2	16.7	17.5	22.8	17.7	11.8	16.6	12.6
Writing Skills	15.9	18.5	20.1	25.3	19.0	12.9	18.7	13.9
Study Skills	26.5	31.8	28.9	23.5	24.9	20.7	23.1	21.7
Part-Time Work	43.6	53.8	43.3	40.9	45.2	39.0	41.5	40.0
Personal Counseling	4.9	5.1	4.5	5.4	5.3	3.4	5.5	3.6
Seeking Assistance	87.8	94.7	92.0	89.7	91.0	80.5	86.9	81.2
Number Responding	3,896	81,566	14,796	25,158	9,190	756,767	21,539	948,359

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors, 1979*, p. 17.

Chart III-4: Intended undergraduate fields of college-bound seniors, by combined average SAT scores, 1978-79

College-bound seniors planning to study the physical sciences and mathematics have higher SAT scores on the average than those planning to major in other fields.

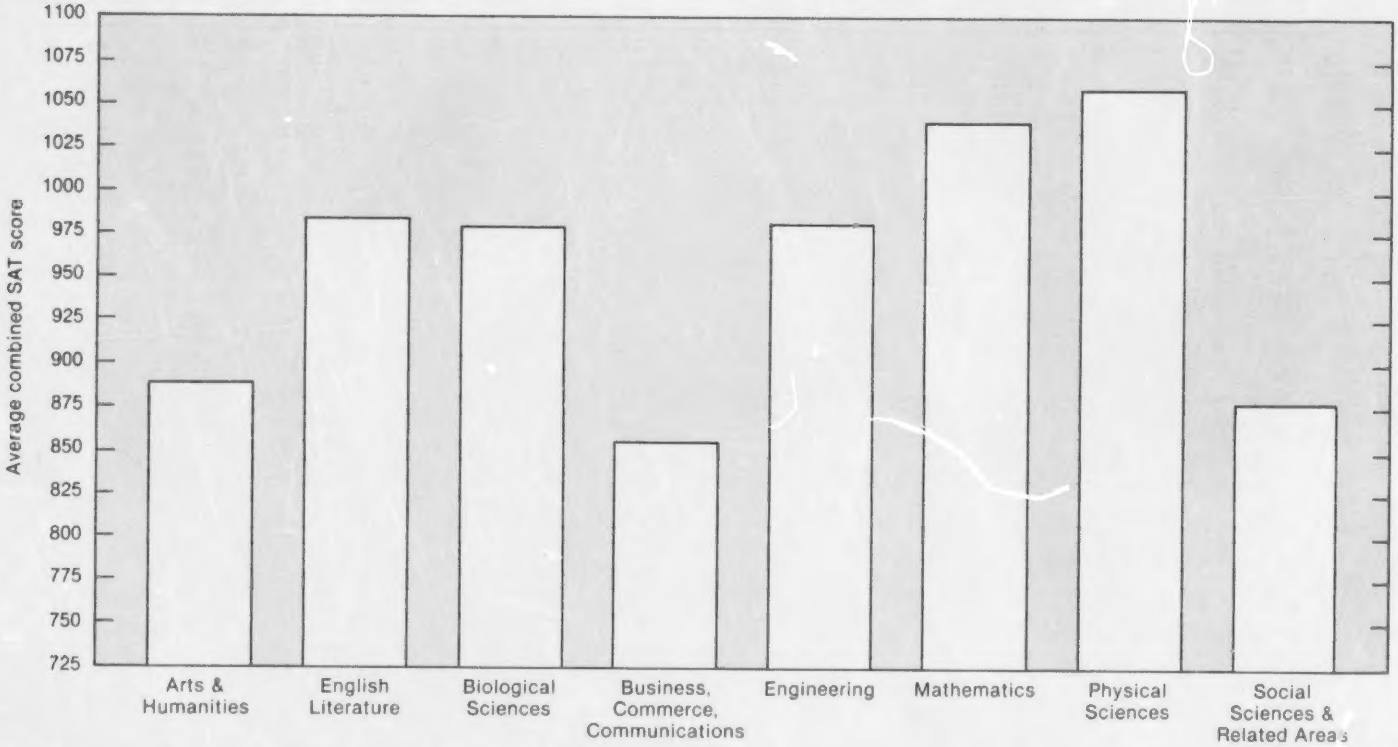

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Table III-4: Intended undergraduate fields of college-bound seniors by SAT scores, 1978-79

Number Responding 912,896 Total	SAT Verbal Mean	SAT Math Mean	SAT Totals
Arts and Humanities	436	452	888
Architecture/Environmental Design	418	495	913
Art	404	421	825
English/Literature	505	478	983
Foreign Languages	475	476	951
Music	437	456	893
Philosophy and Religion	465	482	947
Theater Arts	437	433	870
Biological Sciences and Related Areas	435	472	907
Agriculture	408	443	851
Biological Sciences	472	507	979
Forestry/Conservation	420	456	876
Health and Medical	430	469	899
Business, Commerce, and Communications	408	448	856
Business and Commerce	400	447	847
Communications	448	449	897
Physical Sciences and Related Areas	448	535	917
Computer Science/Systems Analysis	419	498	917
Engineering	445	536	981
Mathematics	459	580	1039
Physical Sciences	498	561	1059
Social Sciences and Related Areas	429	449	878
Education	392	420	812
Ethnic Studies	372	386	758
Geography	438	481	919
History and Cultures	478	471	949
Home Economics	389	417	806
Library Science	476	448	924
Military Science	434	481	915
Psychology	435	447	882
Social Sciences	455	472	927
Miscellaneous	420	458	878
Other	396	430	826
Trade and Vocational	353	394	747
Undecided	441	480	921

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors, 1979*, p. 18.

Chart III-5: K-12 science, mathematics, and social studies teachers' needs for assistance

A total of 67% of teachers reported needing assistance in obtaining information about new instructional materials. Of that number, less than half received adequate assistance.

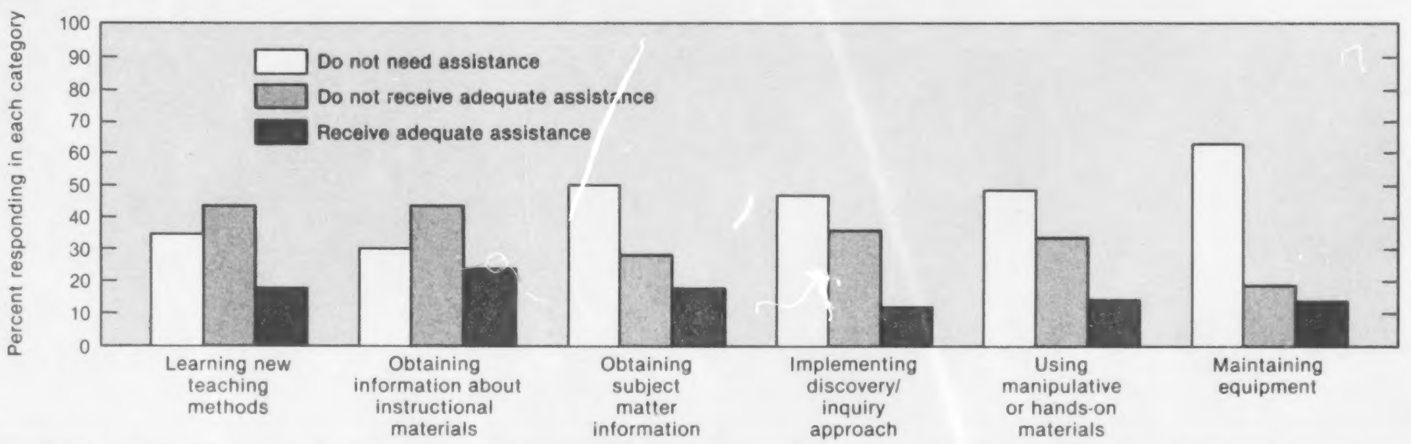


Table III-5: K-12 science, mathematics, and social studies teachers' needs for assistance

	Percent of Teachers			
	Do Not Need Assistance	Do Not Receive Adequate Assistance	Receive Adequate Assistance	Missing
Establishing instructional objectives	70	15	11	4
Lesson planning	83	9	5	4
Learning new teaching methods	34	43	18	4
Actually teaching lessons	78	14	5	4
Obtaining information about instructional materials	30	43	24	4
Obtaining subject matter information	50	28	18	5
Implementing discovery/inquiry approach	47	36	12	5
Using manipulative or hands-on materials	48	33	14	5
Maintaining equipment	62	19	14	4
Working with small groups of students	60	29	6	4
Maintaining discipline	82	8	6	3
Articulating instruction across grade levels	57	29	8	6
Sample N = 4829				

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 147.

Chart III-6: K-12 science, mathematics and social studies teachers' perceptions of classroom needs

Issues related to facilities, equipment and space for classroom preparation are more troublesome in science classes than in mathematics or social studies classes. However, the availability of lab assistants or paraprofessionals and money to buy supplies on a day-to-day basis were seen as problems for teachers of all three subjects.

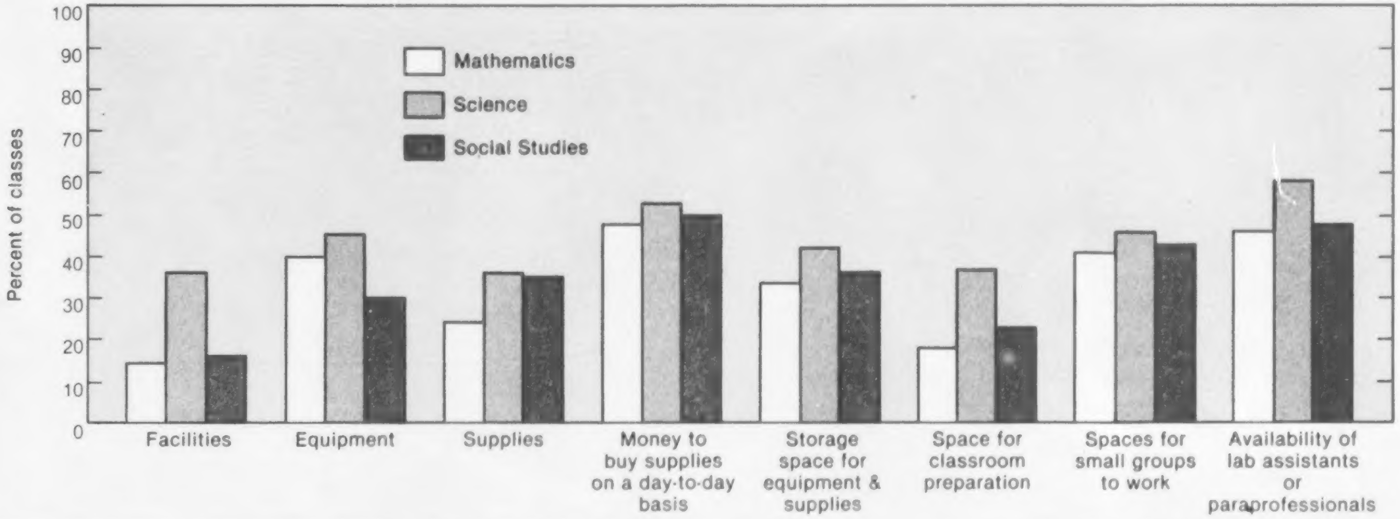


Table III-6: K-12 science, mathematics, and social studies teachers' perceptions of classroom needs (by percent of classes)

Area	Mathematics					Science					Social Studies				
	K-3	4-6	7-9	10-12	Total	K-3	4-6	7-9	10-12	Total	K-3	4-6	7-9	10-12	Total
Facilities	7	13	20	8	14	27	42	44	34	36	12	13	24	17	16
Equipment	36	52	40	30	40	46	55	38	35	45	26	28	33	32	30
Supplies	22	36	22	13	24	38	53	27	21	36	27	38	38	39	35
Money to Buy Supplies on a Day-to-Day Basis	48	57	43	39	48	49	57	57	47	53	46	53	53	52	50
Storage Space for Equipment and Supplies	36	35	30	29	33	40	50	42	39	42	31	39	38	38	36
Space Available for Classroom Preparation	24	13	17	13	18	30	50	39	28	37	17	20	28	27	23
Spaces for Small Groups to Work	33	43	49	41	41	35	54	56	44	46	28	42	53	51	43
Availability of Laboratory Assistants or Paraprofessional Help	37	54	51	46	46	48	56	72	62	58	42	50	54	48	48
Sample N	297	277	550	549	1672	287	271	535	586	1679	254	281	453	490	1478

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 135.

Chart III-7: K-12 mathematics teachers' perceptions of problem areas

For the most part, mathematics teachers do not seem beleaguered by problems. In only two categories insufficient funds for purchasing equipment and supplies, and lack of materials for individualizing instruction, did the combined problem options account for more than 50% of the responses and n category received as much as a 20% response indicating a serious problem.

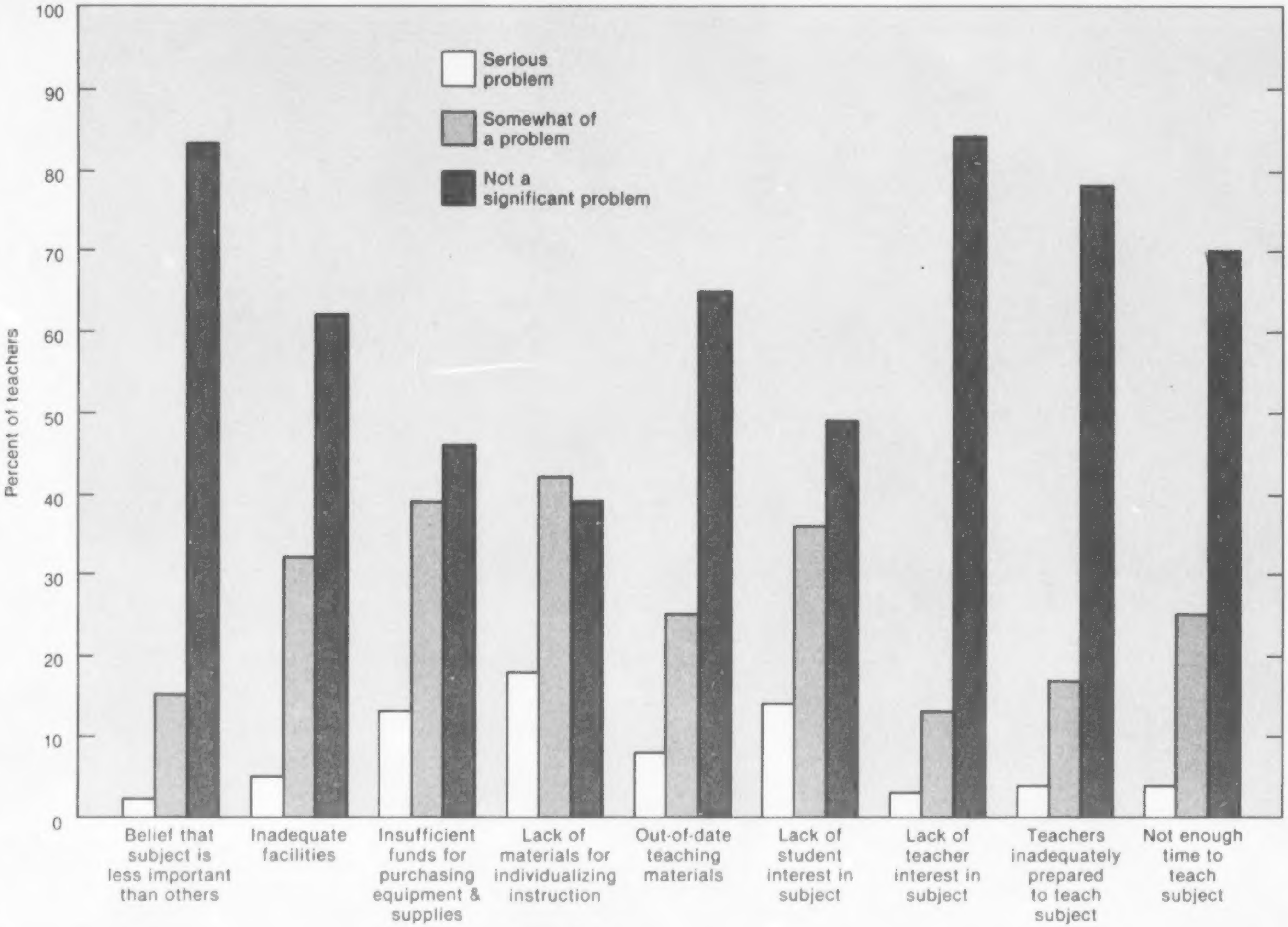


Chart III-8: K-12 science teachers' perceptions of problem areas

Compared to the mathematics teachers, science teachers perceive science instruction as having more problems. In three categories — inadequate facilities, insufficient funds for purchasing equipment and supplies, and lack of materials for individualizing instruction — the two problem options accounted for more than 50% of the responses and the same three categories received more than 25% response as indicating a serious problem.

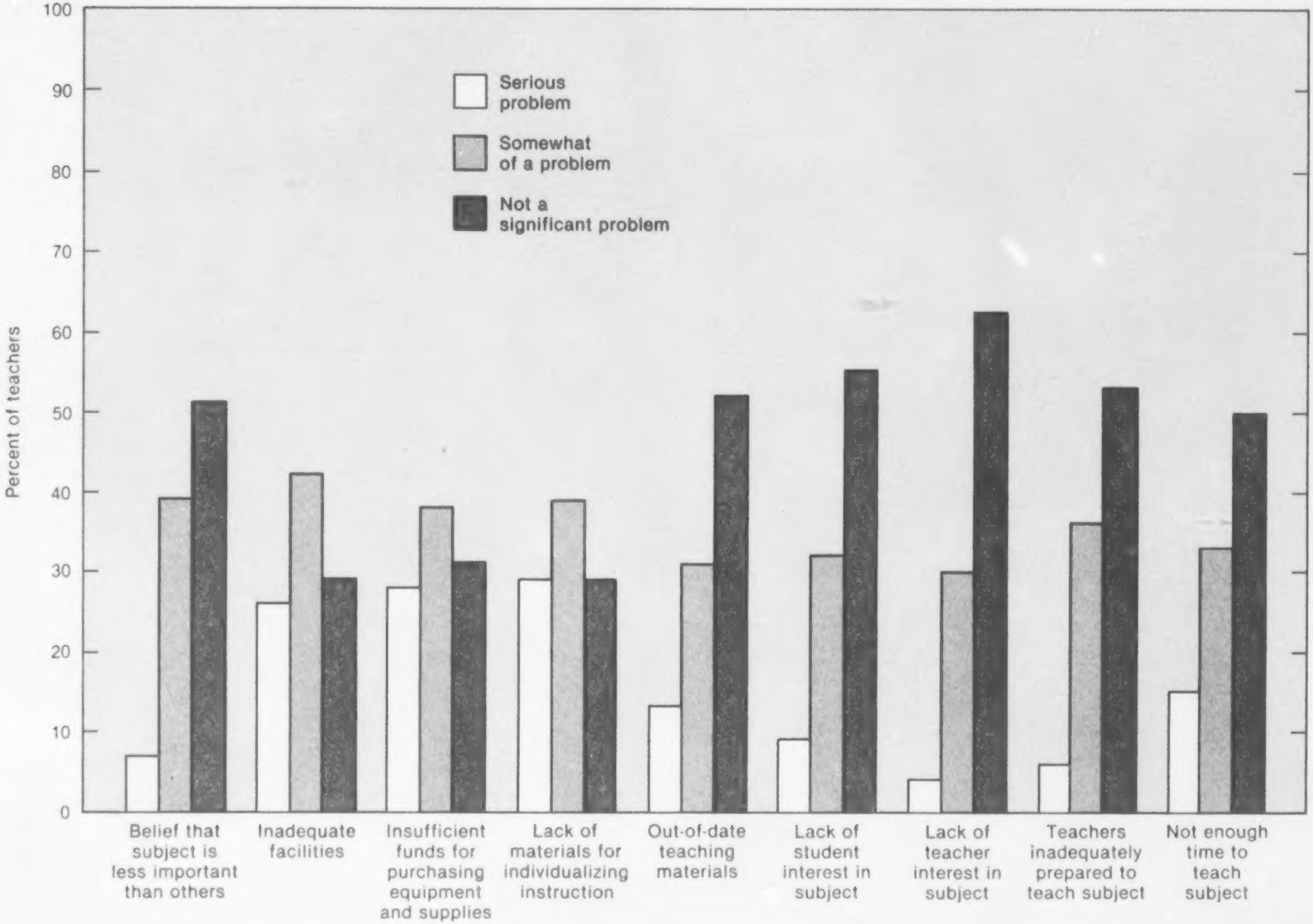


Chart III-9: K-12 social studies teachers' perceptions of problem areas

Compared to the mathematics and science teachers, social studies teachers perceive social studies instruction as having more problems. In six categories, the two problem options accounted for 50% or more of the responses: insufficient funds for purchasing supplies and equipment, lack of materials for individualizing instruction, out-of-date teaching materials, lack of student interest in subject, inadequate student reading abilities, and belief that the subject is less important than other subjects.

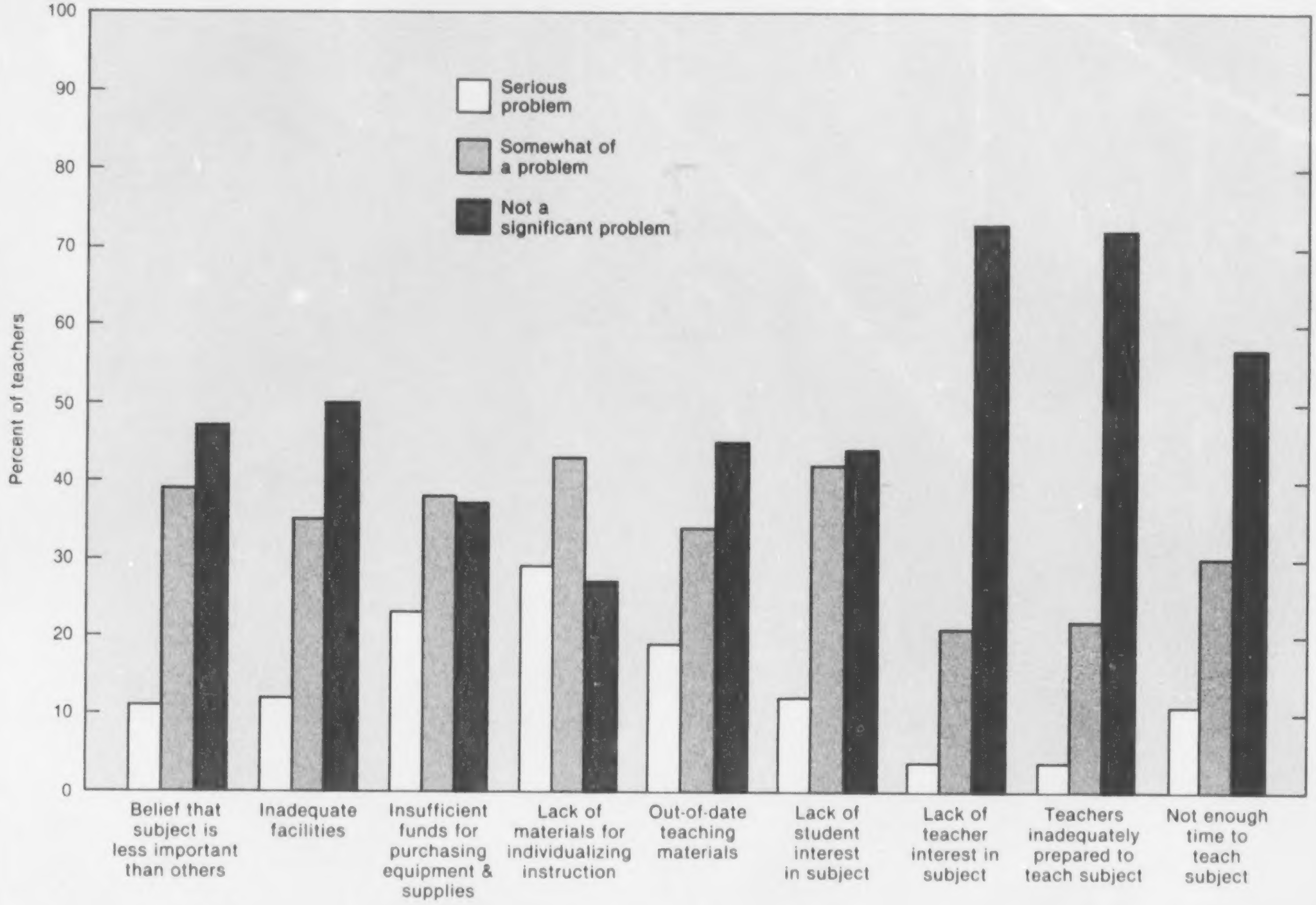


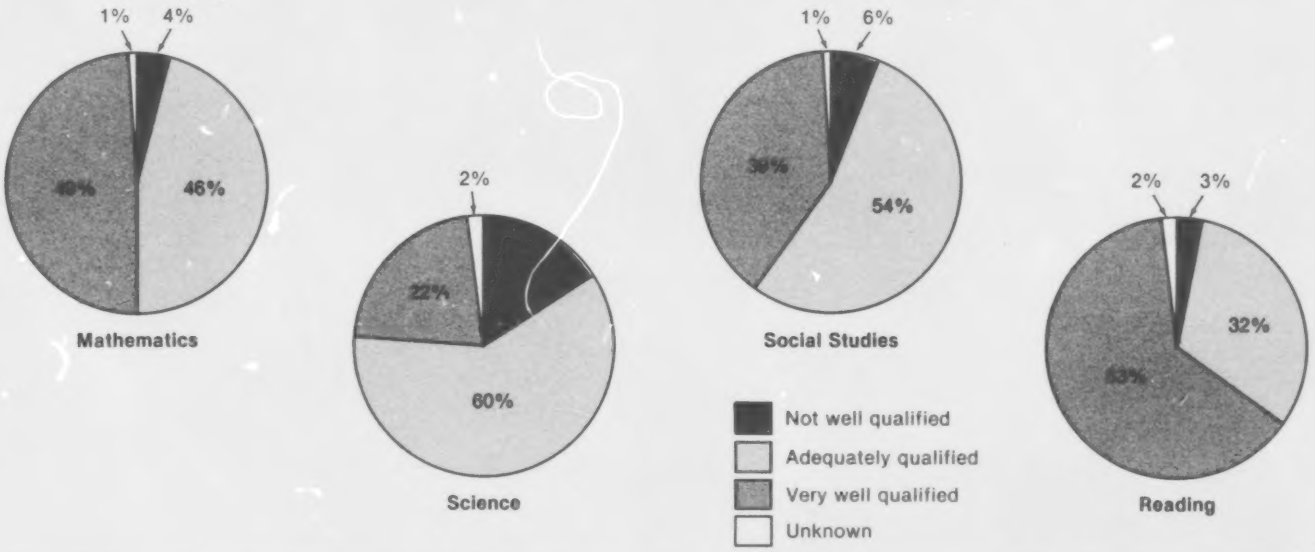
Table III-7, 8, 9: K-12 mathematics, science and social studies teachers' perceptions of problem areas

Factor	Mathematics				Science				Social Studies			
	Serious Problem	Somewhat of a Problem	Not a Significant Problem	Missing	Serious Problem	Somewhat of a Problem	Not a Significant Problem	Missing	Serious Problem	Somewhat of a Problem	Not a Significant Problem	Missing
Belief that this subject is less important than other subjects	2	15	83	1	7	39	51	3	11	39	47	2
Compliance with Federal regulations	1	8	88	2	3	14	74	9	3	13	81	4
Inadequate facilities	5	32	62	2	26	42	29	2	12	35	50	3
Insufficient funds for purchasing equipment and supplies	13	39	46	2	28	38	31	4	23	38	37	2
Lack of materials for individualizing instruction	18	42	39	1	29	39	29	3	29	43	27	2
Out-of-date teaching materials	8	25	65	2	13	31	52	4	19	34	45	2
Insufficient numbers of textbooks	4	13	82	1	9	15	71	5	12	20	66	2
Lack of student interest in subject	14	36	49	2	9	32	55	4	12	42	44	2
Inadequate student reading abilities	24	47	28	1	24	43	29	4	32	44	21	2
Lack of teacher interest in subject	3	13	84	1	4	30	62	5	4	21	73	2
Teachers inadequately prepared to teach subject	4	17	78	1	6	36	53	5	4	22	72	2
Lack of teacher planning time	11	32	55	2	18	38	40	4	16	31	52	2
Not enough time to teach subject	4	25	70	1	15	33	50	3	11	30	57	2
Class sizes too large	19	38	42	1	15	34	49	3	18	31	49	2
Difficulty in maintaining discipline	8	28	63	1	5	24	68	3	5	23	70	2
Inadequate articulation of instruction across grade levels	9	34	55	2	9	40	45	6	11	37	50	3
Inadequate diversity of electives	5	20	69	6	8	29	54	9	10	28	57	6
Low enrollments in courses	3	10	82	6	3	11	77	9	2	10	82	7
Sample N	1672				1679				1478			

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 158.

Chart III-10: Elementary teachers' perception of their qualifications, by subject

Nearly two-thirds of all elementary teachers feel "very well qualified" to teach reading, while only 22% feel "very well qualified" to teach science. At the other end of the scale, 16% of the teachers feel "not well qualified" to teach science, compared to 6% or fewer in each of the other three areas.



Source: Weiss, Iris R., *et al, The Status of Pre-College Science, Mathematics, and Social Studies Educational Practices in U.S. Schools: An Overview and Summaries of Three Studies*, p. 13.

Table III-10: Elementary teachers' perceptions of their qualifications to teach each subject

Subject	Percent of Teachers Not Well Qualified	Adequately Qualified	Very Well Qualified	Missing
Mathematics	4	46	49	1
Science	16	60	22	2
Social Studies	6	54	39	1
Reading	3	32	63	2
Sample N = 1667				

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 142.

Chart III-11: Secondary school teachers' perceptions that they are inadequately qualified to teach one or more of their classes

While most secondary school science, mathematics, and social studies teachers feel at least adequately qualified to teach all of their courses, a sizable number of them feel inadequately qualified to teach one or more of their courses.

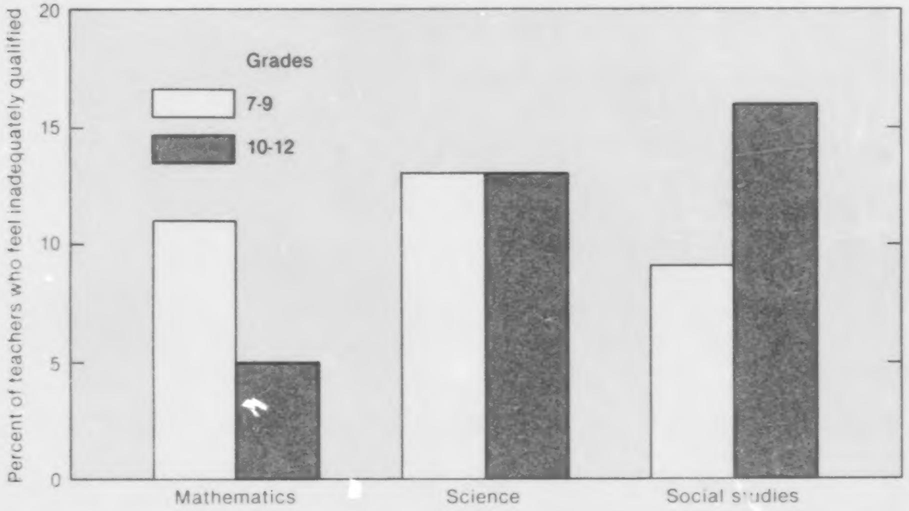


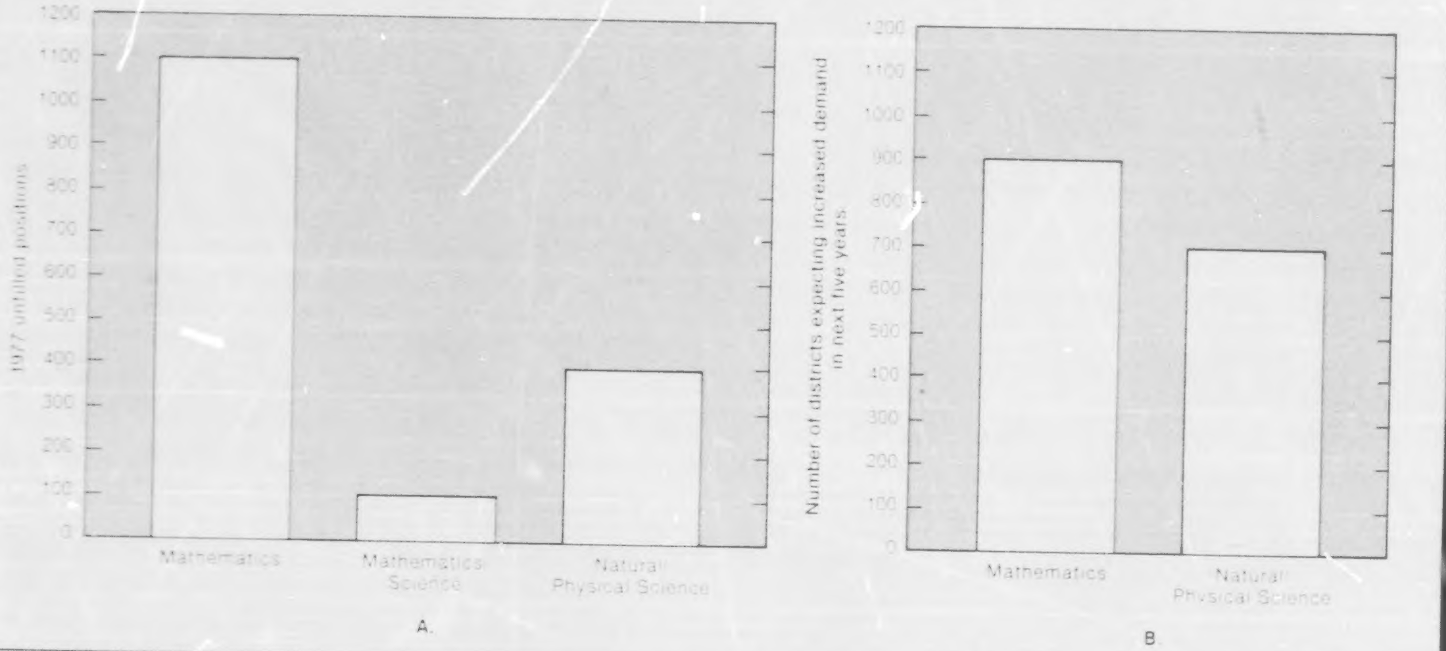
Table III-11: Percent of secondary teachers of each subject who feel inadequately qualified to teach one or more of their courses

	Yes	No	Unknown
Mathematics			
7-9 (N = 550)	11	88	1
10-12 (N = 548)	5	95	0
Science			
7-9 (N = 535)	13	86	1
10-12 (N = 586)	13	82	3
Social Studies			
7-9 (N = 453)	9	89	2
10-12 (N = 490)	16	81	3

Source: Weiss, Iris R., *Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education*, p. 144.

Chart III-12: A. 1977 Unfilled teacher positions, and B. Teacher demand estimates for the next five years

Among subject matter specialties, as opposed to the teaching specialties such as special education and bilingual education, mathematics is the subject with both the most unfilled positions and the greatest demand projections. The need for science teachers is also expected to increase.



A.

B.

Table III-12A: Estimated[1] unfilled teacher positions[2]: Fall 1977

Level and field	Unfilled teacher positions
All districts	9,200
Level:	
Elementary	3,700
Secondary	4,500
Elementary and secondary	1,000
Selected fields:	
General elementary	300
Art	(3)
Bilingual education	1,200
Business	(3)
English language arts	200
Foreign languages	(3)
Health, physical education	200
Home economics (nonoccupational)	(3)
Industrial arts	300
Mathematics	1,100
Music	200
Natural and physical sciences	400
Reading	300
Social studies	(3)
Vocational education	300
Mathematics/science	100
English/social studies	(3)
Special education:	
Gifted and talented	400
Severely handicapped	200
Moderately and mildly handicapped:	
Emotionally disturbed	300
Learning disabled	1,500
Mentally retarded	500
Speech impaired	600
Other	300

[1] National estimates based on a sample of 507 of the 15,344 school districts.

[2] Position openings for which teachers were sought but were unable to be hired because qualified candidates were unavailable.

[3] Estimated number greater than zero but less than 50.

Source: Golladay, Mary A. and Noell, Jay, *The Condition of Education, 1978 Edition*, p. 172.

Table III-12B: Fields for which school districts report demand for teachers will increase in the next 5 years: Fall 1977

Field	Number of districts[1]
Art	500
Bilingual education	500
Business	(2)
English language arts	400
Foreign languages	(2)
Health, physical education	500
Home economics (nonoccupational)	200
Industrial arts	800
Mathematics	900
Music	200
Natural and physical sciences	700
Reading	400
Vocational education, not specified	500
Agriculture	600
Distributive education	(2)
Health occupations	(2)
Occupational home economics	(2)
Office occupations	(2)
Technical education	200
Trade and industry	100
Special education, not specified	600
Severely handicapped	300
Emotionally disturbed	300
Learning disabled	1,200
Mentally retarded	200
Speech impaired	200
Gifted and talented	1,000
Other special education	500
Others	300

[1] National estimates based on a sample of 507 of the 15,344 school districts.

[2] Estimated number greater than zero but less than 50.

Source: Golladay, Mary A. and Noell, Jay, *The Condition of Education, 1978 Edition*, p. 174.

Chart III-13: Public view of subjects essential to all high school students

Mathematics is viewed as essential by more people than any other subject. Science ranked fifth out of eleven subjects.

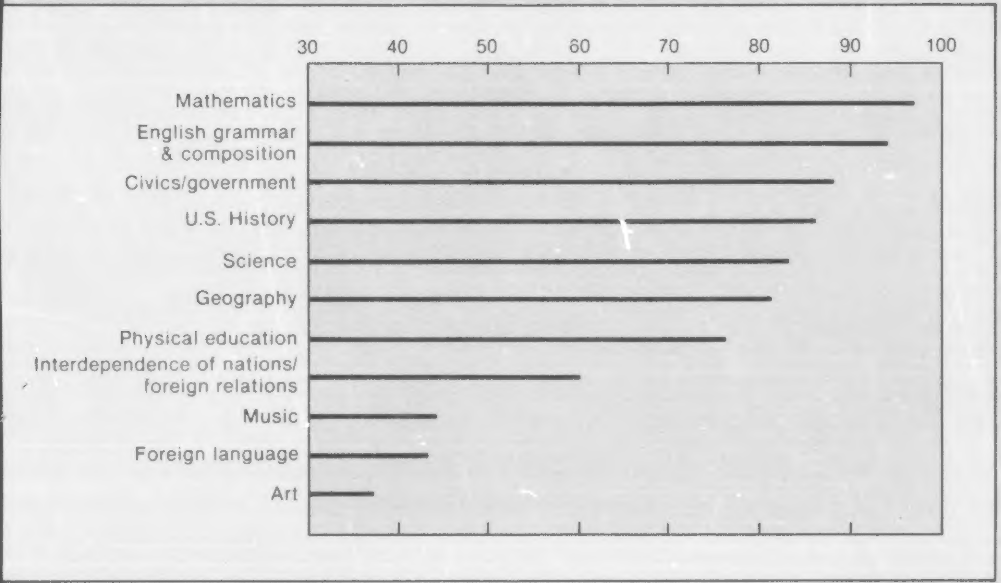


Table III-13: Public view of subjects essential to all high school students

	National Totals		
	Essential %	Not Too Essential %	Don't Know/ No Answer %
Mathematics	97	1	2
English grammar & composition	94	3	3
Civics/government	88	8	4
U.S. history	86	11	3
Science	83	14	3
Geography	81	16	3
Physical education	76	21	3
Interdependence of nations—foreign relations	60	32	8
Music	44	52	4
Foreign language	43	53	4
Art	37	58	5

Source: Gallup, George H. © 1979, Phi Delta Kappa, Inc., "The Eleventh Annual Gallup Poll of the Public's Attitudes Toward the Public Schools," *Phi Delta Kappan*, September, 1979.

Chapter IV
TEST DATA

INTRODUCTION

No measure of the health of American education receives as much scrutiny as student test data. Recent attention has focused on measures of what people know and what intellectual and performance skills they possess. Such measures are usually standardized tests (e.g., Scholastic Aptitude Tests, Graduate Record Examinations, National Assessment of Educational Progress instruments). A distinction can be made between aptitude (SAT, GRE) and achievement tests (NAEP). "Aptitude" is considered to be a relatively fixed quantity, while "achievement" is considered to be dependent on experience and application. The mutual interaction of aptitude and achievement is by no means clear or understood, however, and therefore test data requires a balanced and thoughtful scrutiny.

The test data contained in this chapter are grouped for K-12 students and higher education students.

HIGHLIGHTS

K-12

1. Although Scholastic Aptitude Test (SAT) scores have declined for the past ten years, the rate of decline for mathematics aptitude is not nearly as great as that for verbal aptitude. (Chart IV-1)
2. Regarding SAT scores, the mathematics scores for men have consistently been well above those for women, and since 1972 verbal scores for men have also exceeded those of women. (Chart IV-1)
3. In contrast to the SAT scores, the Admissions Testing Program Achievement Tests scores, averaged across all subjects, have held steady over the past six years, within a range of 526 in 1972 to 538 in 1976. (Chart IV-2)
4. According to National Assessment of Educational Progress (NAEP) data, all age groups experienced statistically significant declines in science achievement during the first test interval (1969-70 to 1972-73). There were no significant changes during the second test interval (1972-73 to 1976-77). (Chart IV-3)
5. When analyzed separately as to type science, NAEP data showed that all ag groups experienced statistically significa declines in physical science achieveme during the first test interval. Only the declir of the 9-year-olds was significant during th second interval. (Chart IV-4)
6. In biological science achievement, NAE data shows that the only statistically signi cant change is the decline demonstrated 17-year-olds during the first test interva (Chart IV-5)
7. According to NAEP data, overall mathema ics achievement declined for all ages teste in the test interval 1973 to 1978. The declir was statistically significant for the 13- ar 17-year-olds. (Chart IV-6)

Higher Education

As reflected by Graduate Record Examinatic (GRE) scores there were no statistically significa changes in either the verbal or quantitative ap tudes of prospective science graduate student (Charts IV-7, 8)

Chart IV-1: Scholastic Aptitude Test score averages for college-bound seniors, 1967-79

SAT scores have declined during the past ten years. The mathematical score for both males an females has declined by 26 points while the verbal score has declined by 36 points. Men have co sistently scored well above women in mathematics, and since 1972 have been scoring somewhat abov women in verbal aptitude as well.

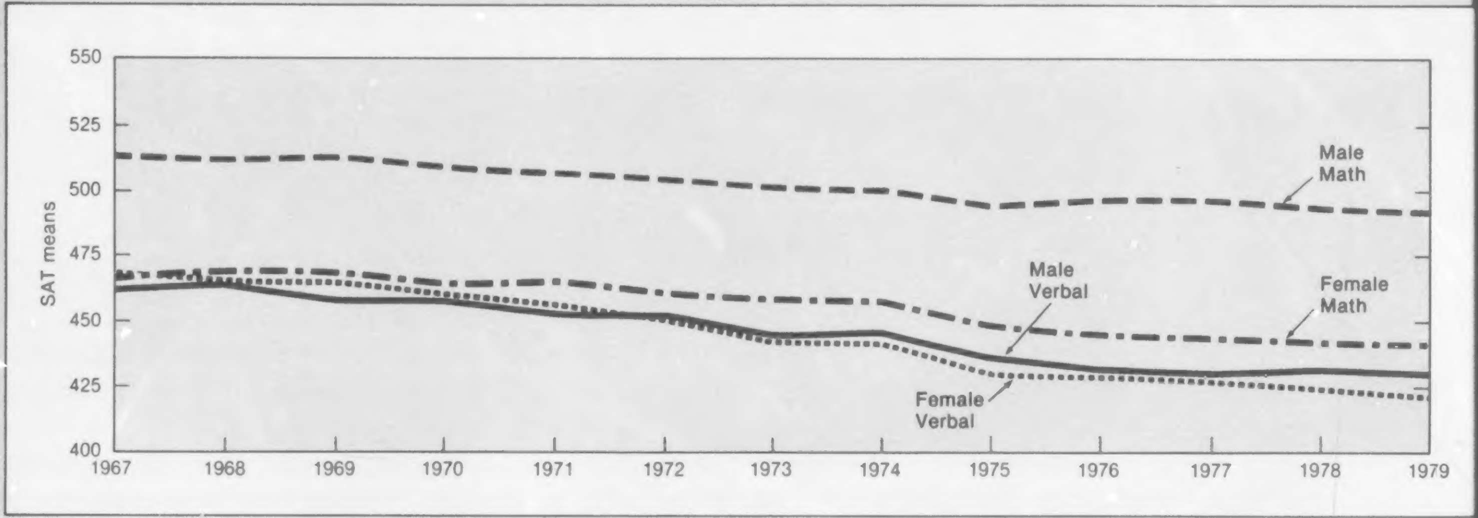


Table IV-1: SAT score averages for college-bound seniors, 1967-79*

	Mathematical			Verbal		
SAT	Male	Female	Total	Male	Female	Total
1967	514	467	492	463	468	466
1968	512	470	492	464	466	466
1969	513	470	493	459	466	463
1970	509	465	488	459	461	460
1971	507	466	488	454	457	455
1972	505	461	484	454	452	453
1973	502	460	481	446	443	445
1974	501	459	480	447	442	444
1975	495	449	472	437	431	434
1976	497	446	472	433	430	431
1977	497	445	470	431	427	429
1978	494	444	468	433	425	429
1979	493	443	467	431	423	427

*The averages for 1967 through 1971 are estimates of the averages that would have been reported for college-bound seniors of those years if such reports had been produced.

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors*, 1979, p. 5.

Chart IV-2: Admissions testing program achievement test score averages, 1972-79

Although the average SAT scores are generally down, the average SAT scores for takers of the ATP Achievement Tests have been steady, as have the average Achievement Test scores themselves. The average Achievement Test scores range from 526 (1972) to 538 (1976). The number of students taking the Achievement Tests, however, decreased 40% between 1972 and 1979. Also, the average scores for physics and both mathematics tests declined significantly from 1978 to 1979.

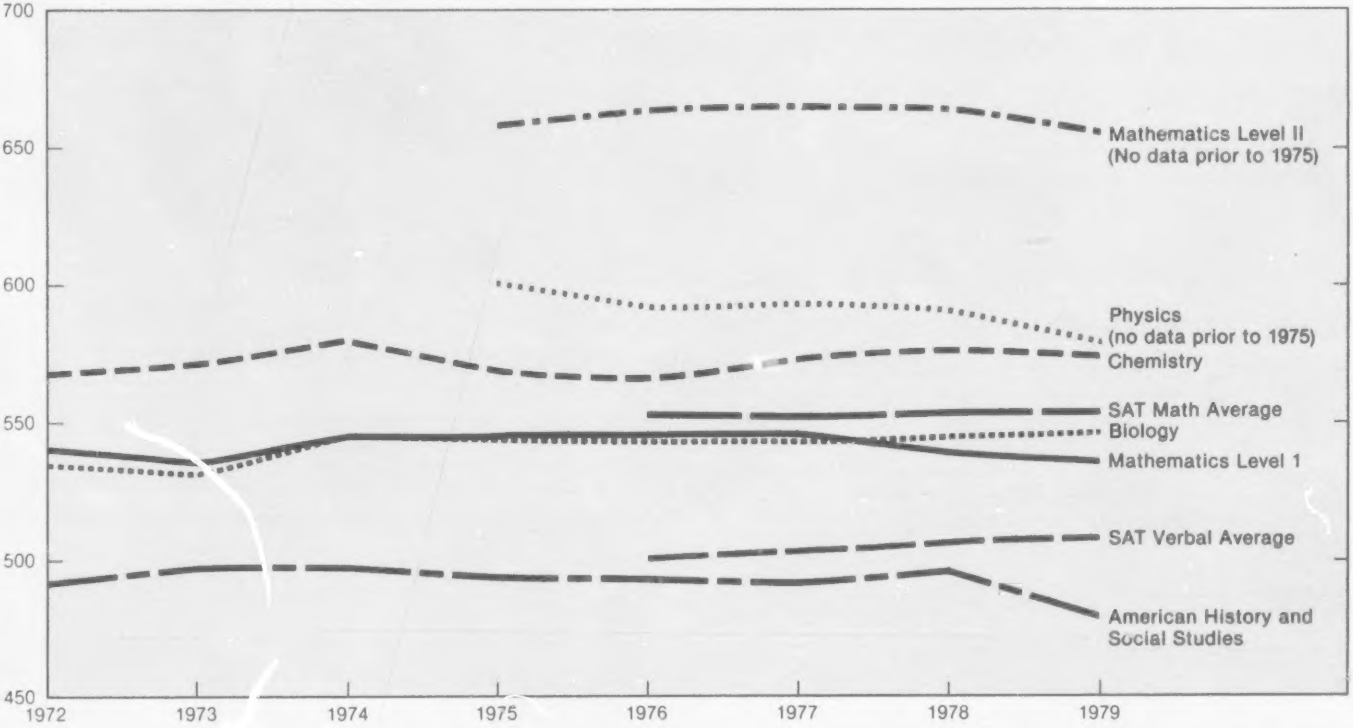


Table IV-2: ATP achievement test score averages, 1972-79

(Numbers in thousands)

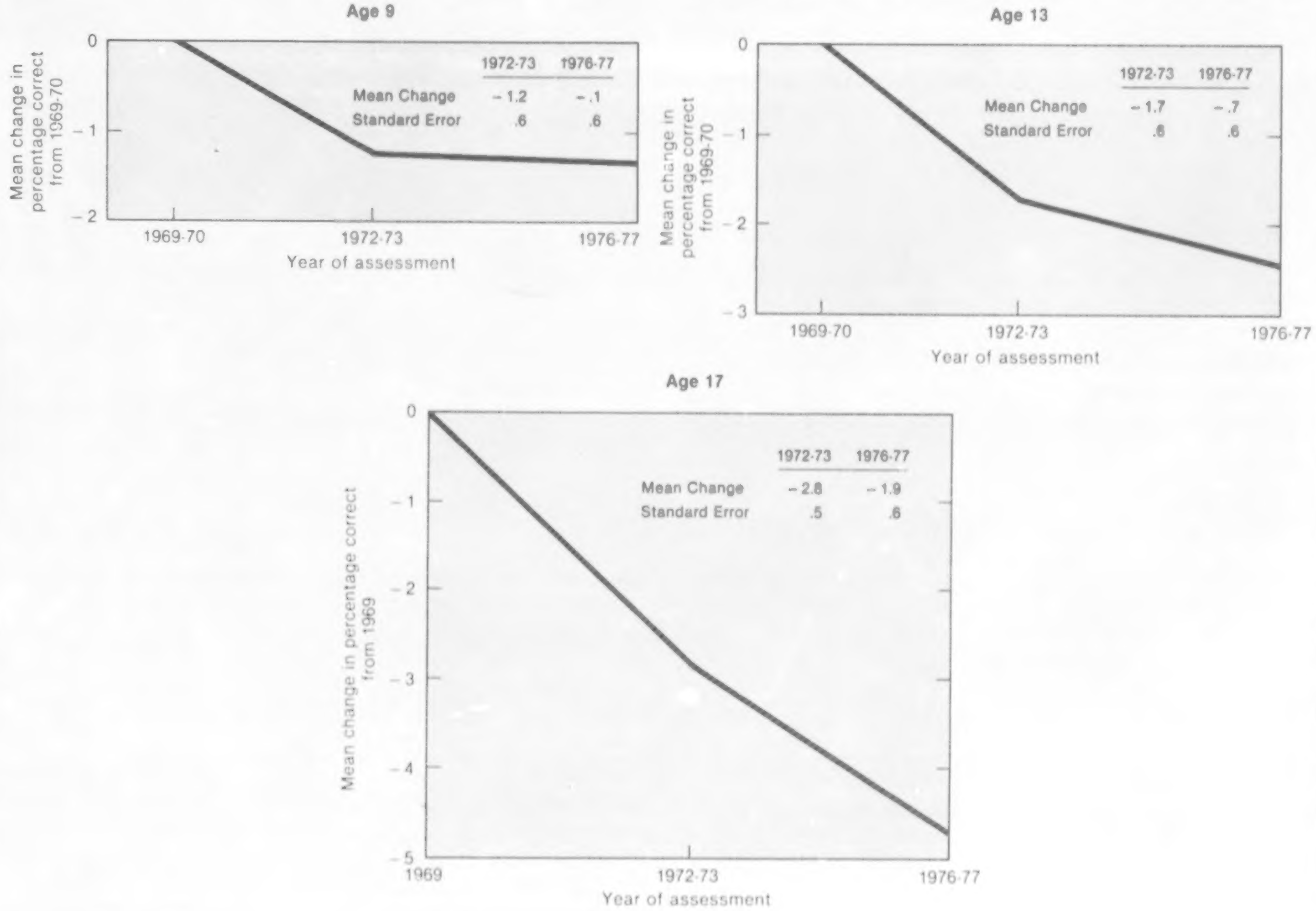
	1972		1973		1974		1975		1976		1977		1978		1979	
	N	*AV*	*N*	*AV*	*N*	*AV*	*N*	*AV*	*N*	*AV*	*N*	*AV*	*N*	*AV*	*N*	*AV*
Average for all Achievement Tests	335	526	294	527	247	533	228	531	228	538	213	533	209	531	201	529
English Composition	313	516	275	517	228	517	212	515	213	532	201	516	195	512	187	514
Mathematics Level I	240	541	211	537	172	545	158	545	158	546	150	547	146	541	146	537
American History and Social Studies	105	492	87	498	71	498	64	494	64	493	63	492	61	496	58	480
Biology	51	535	51	532	46	545	46	544	46	543	45	543	47	544	43	547
Chemistry	48	568	43	572	37	581	33	569	34	567	35	574	35	577	35	575
Mathematics Level II	n/a		n/a		n/a		29	660	32	665	30	666	33	665	34	657
French	52	539	47	544	38	560	34	553	31	553	27	553	26	552	24	554
Spanish	34	530	33	539	28	560	26	544	26	547	24	535	24	554	24	542
Literature	n/a		n/a		n/a		21	522	22	525	19	526	18	521	17	522
Physics	n/a		n/a		n/a		12	601	16	592	16	593	15	591	15	580
German	n/a		n/a		n/a		7	547	6	555	6	551	5	553	5	550
European History and World Cultures	n/a		n/a		n/a		5	521	3	531	2	526	3	507	3	516
Latin	n/a		n/a		n/a		2	514	2	524	1	517	1	508	2	524
Hebrew	n/a		n/a		n/a		1	577	1	579	1	581	1	589	1	588
Russian	n/a		n/a		n/a		0.5	540	1	559	0.4	575	0.4	587	0.3	613
Average SAT scores for takers of Achievement tests*																
Verbal									501		504		507		508	
Mathematics									553		553		554		554	

*Data not computed prior to 1976. Data for 1976 are estimated from scores of individual achievement tests for that year.

Source: Admissions Testing Program of the College Board, *National Report, College Bound Seniors, 1977*, p. 8, *1978*, pp. 13-14, *1979*, pp. 13-14.

Chart IV-3: Changes in science achievement for 9-, 13- and 17-year-olds: 1969-77

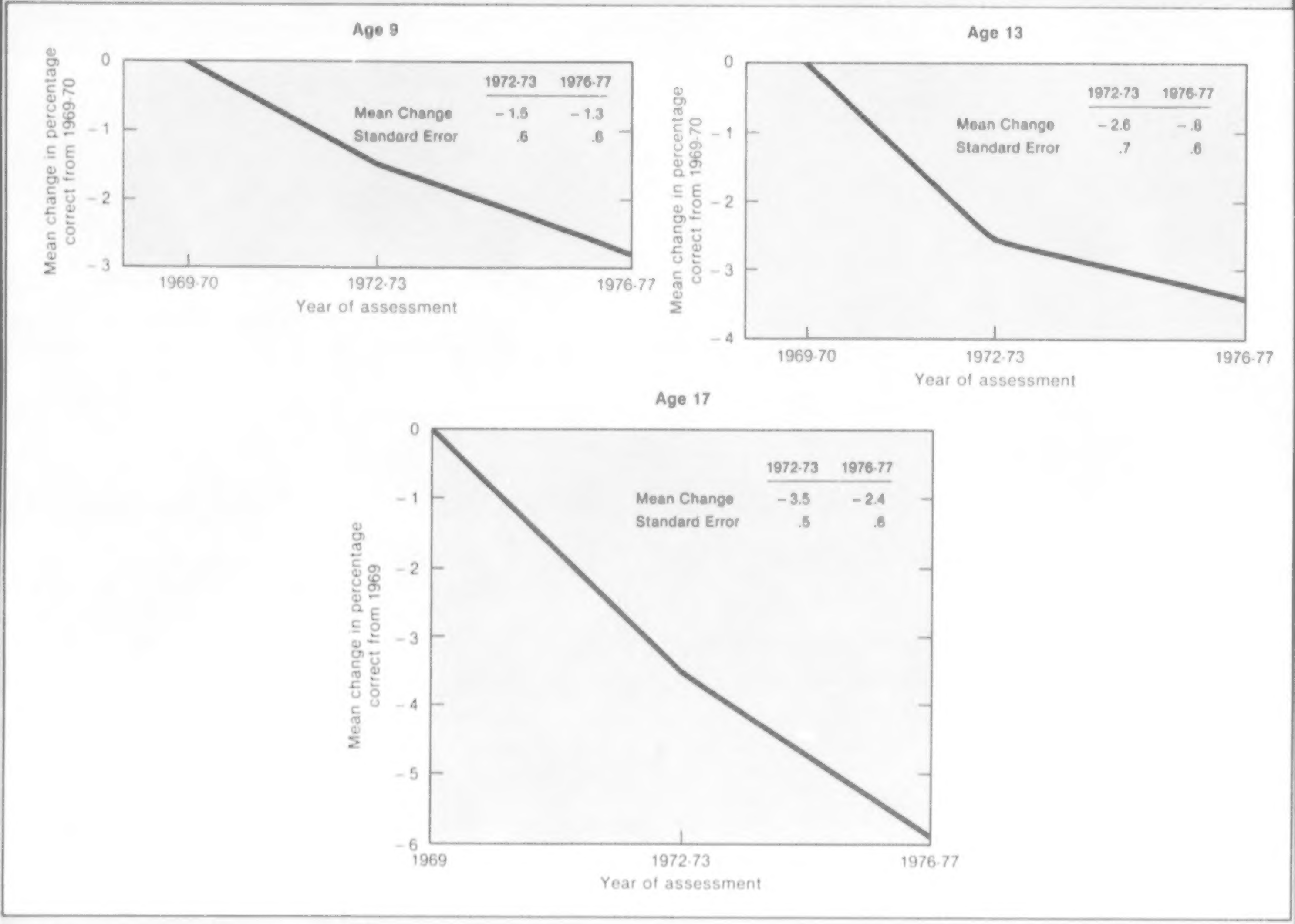
Overall achievement in science declined for all age groups at every test interval. All three declines in the first National Assessment and Educational Progress NAEP Testing interval were statistically significant (at the .05 level) while only that for 17-year-olds was significant in the second interval.



Source: National Assessment of Educational Progress, *Three National Assessments of Science: Changes in Achievement, 1969-77*, p. 6.

Chart IV-4: Changes in physical science achievement 1969-77 for 9-, 13- and 17-year-olds: National Assessment of Educational Progress

Achievement in the physical sciences declined for all age groups at every test interval. All thre declines in the first interval were statistically significant (at the .05 level) while the declines for the nine year-olds and 17-year-olds were significant in the second interval.



Source: National Assessment of Educational Progress, *Three National Assessments of Science: Changes in Achievement, 1969-77*, p. 8.

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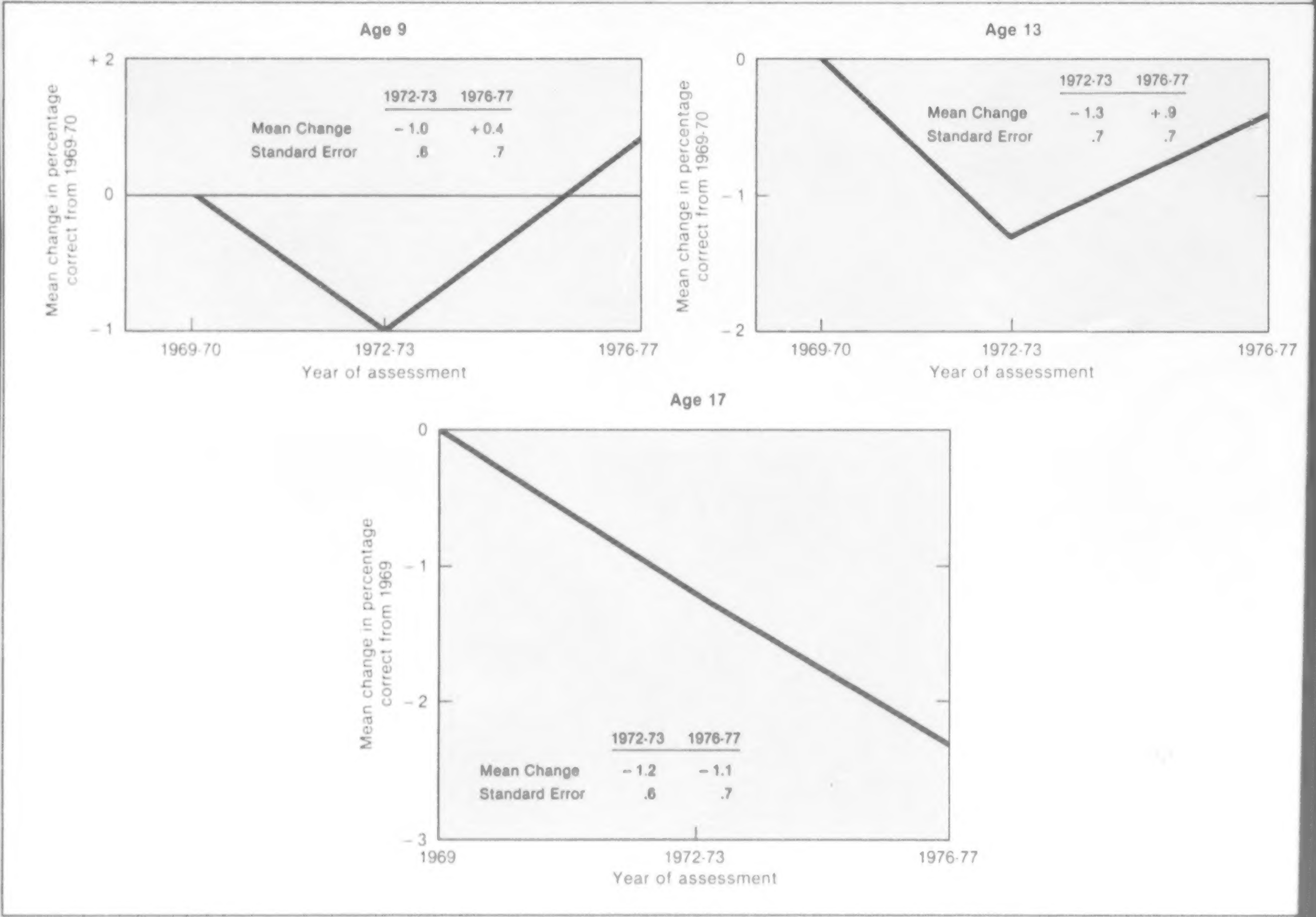
Chart IV-5: Changes in biology achievement 1969-77 for 9-, 13- and 17-year-olds: National Assessment of Educational Progress

Although it appears that achievement in the biological sciences declined for all three age groups in th first interval and continued to decline for 17-year-olds while improving for the younger groups, the onl statistically significant change (at the .05 level) occurred for the 17-year-olds between 1969-70 an 1972-73.



Source: National Assessment of Educational Progress, *Three National Assessments of Science: Changes in Achievement, 1969-77.*, p. 7.

Table IV-3, 4, 5: Change in science achievement, 1969-77 for 9-, 13-, and 17-year-olds: National Assessment of Educational Progress

	1969-70 and 1972-73 items			1972-73 and 1976-77 items		
Item	1969-70[1]	1972-73	Change	1972-73	1976-77	Change
9-year olds						
All exercises						
Mean percent correct	60.97	59.81	* – 1.17	52.33	52.24	– 0.09
Standard error	.35	.44	.56	.42	.45	.62
Physical science						
Mean percent correct	56.70	55.21	* – 1.49	47.50	46.24	* – 1.26
Standard error	.38	.48	.61	.42	.44	.61
Biological science						
Mean percent correct	70.35	69.33	– 1.02	57.85	59.22	1.38
Standard error	.38	.40	.55	.45	.55	.71
13-year-olds						
All exercises						
Mean percent correct	60.18	58.47	* – 1.71	54.47	53.80	– .67
Standard error	.40	.47	.62	.40	.42	.58
Physical science						
Mean percent correct	59.67	57.10	* – 2.58	50.43	49.59	– .84
Standard error	.42	.51	.66	.41	.41	.58
Biological science						
Mean percent correct	60.89	59.63	– 1.26	61.08	61.99	.92
Standard error	.51	.50	.71	.45	.50	.67
17-year-olds						
All exercises						
Mean percent correct	45.25	42.46	* – 2.79	48.41	46.49	* – 1.92
Standard error	.34	.32	.47	.37	.44	.57
Physical science						
Mean percent correct	42.87	39.34	* – 3.52	46.83	44.45	* – 2.38
Standard error	.38	.35	.52	.37	.43	.57
Biological science						
Mean percent correct	52.30	51.12	* – 1.18	53.30	52.19	– 1.12
Standard error	.42	.42	.59	.49	.50	.70

*Change statistically significant at the 0.05 level.

[1] Year of assessment for 17-year-olds is 1969.

Source: Dearman, Nancy B., and Plisko, Valena White, *The Condition of Education, 1979 Edition*, p. 176.

Chart IV-6: Changes in mathematical achievement, 1973-78, for 9-, 13-, and 17-year-olds: National Assessment of Educational Progress

Overall mathematics achievement declined for all three age groups with the decline for the two older groups being statistically significant at the .05 level, with the exception of the knowledge items. Where there were no statistically significant differences, the older the group the steeper the decline in each of the assessed areas.

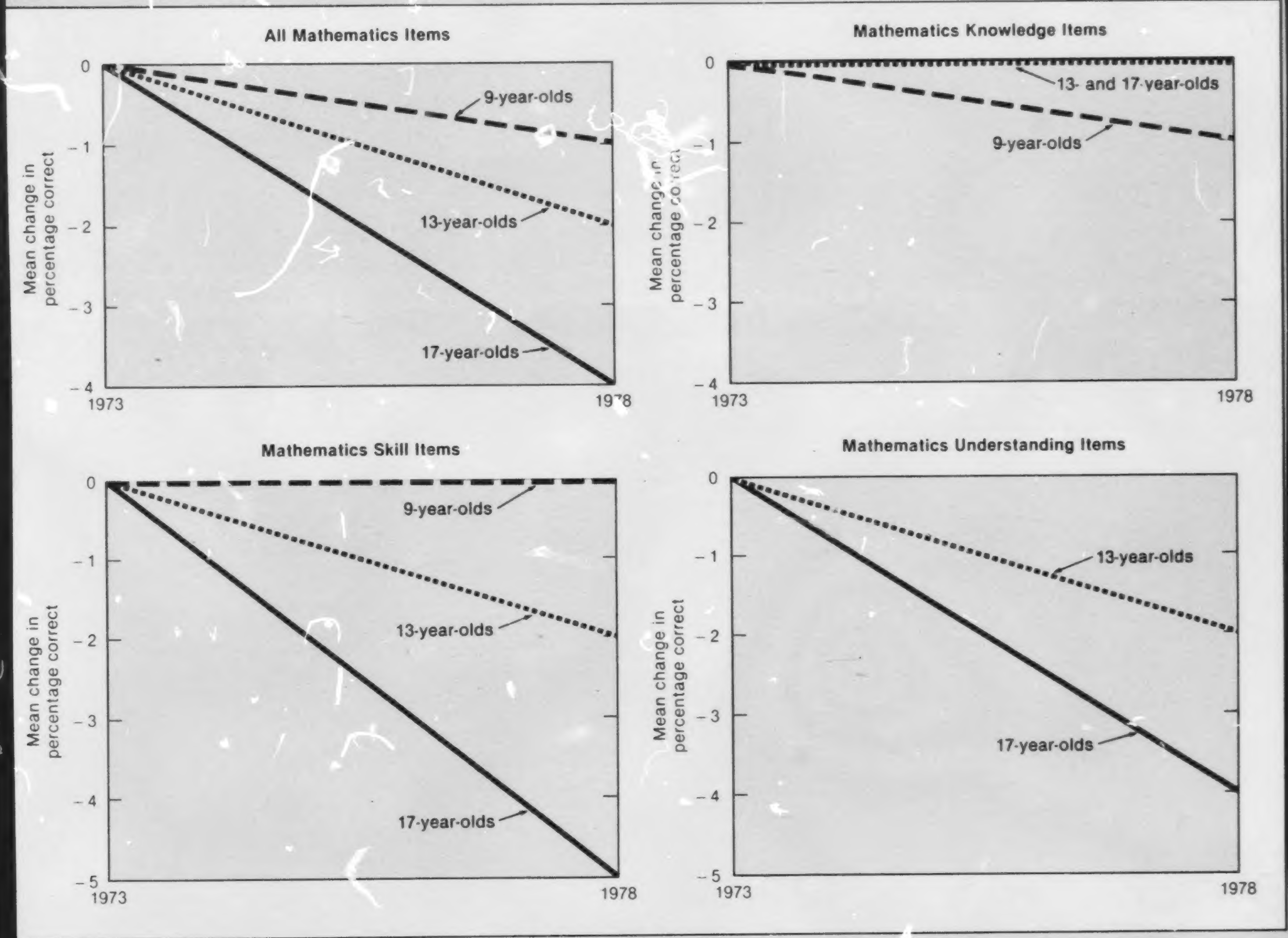


Table IV-3: Changes in mathematical achievement, 1973-78, for 9-, 13-, and 17-year-olds: National Assessment of Educational Progress

	Mean Percent Correct		Change in Mean Percent Correct
	1973	1978	
9-Year-Olds			
All items	38%	37%	−1
Mathematics Knowledge	55	55	−1**
Mathematics Skills	26	26	0
13-Year-Olds			
All items	53	51	−2*
Mathematics Knowledge	64	64	0
Mathematics Skills	51	49	−2*
Mathematics Understanding	52	50	−2
17-Year-Olds			
All items	52	48	−4*
Mathematics Knowledge	63	63	0
Mathematics Skills	55	50	−5*
Mathematics Understanding	62	58	−4*

*Change is significant at the .05 level.

**Figures do not total because of rounding.

Source: National Assessment of Educational Progress, *Changes in Mathematical Achievement, 1973-78*, pp. 1, 2, 4, 10.

Chart IV-7: Graduate Record Examination quantitative aptitude mean scores for prospective graduate students in science, 1970-75

As reflected by GRE scores, there were no statistically significant changes in the quantitative aptitude of prospective science graduate students. However, candidates in the life sciences and basic social sciences averaged noticeably lower than those in other science disciplines.

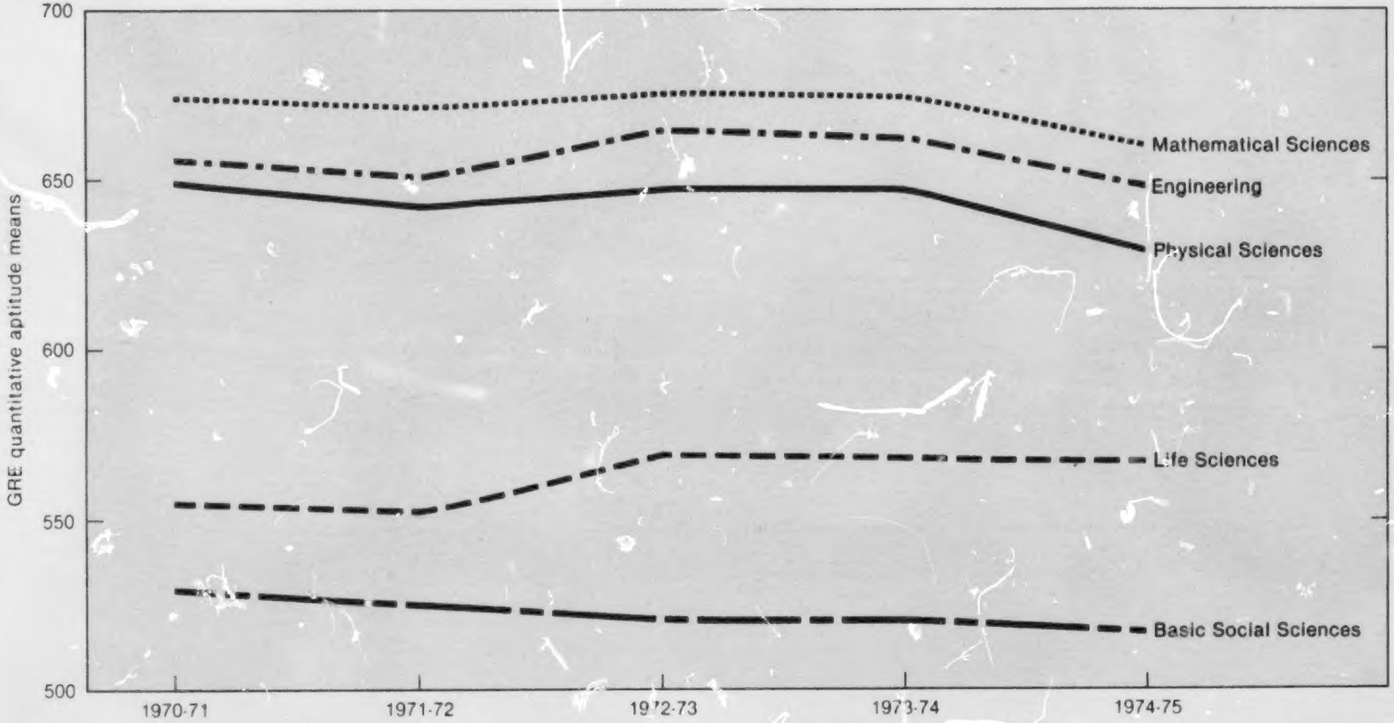


Chart IV-8: Graduate Record Examination verbal aptitude mean scores for prospective graduate students in science, 1970-75

As reflected by GRE scores, there were no statistically significant changes in the verbal aptitude o prospective science graduate students. However, engineering candidates averaged noticeably lowe than those in other science disciplines.

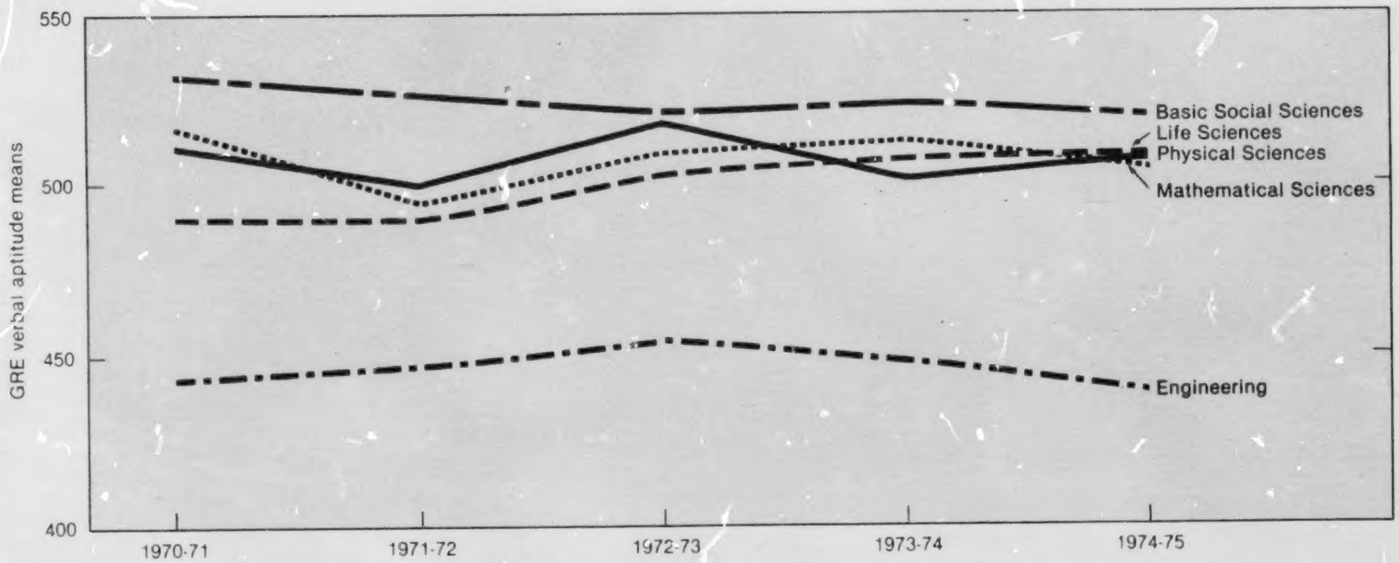


Table IV: 7, 8: Graduate Record Exam test scores: 1970-71 to 1974-75

(Number of cases, mean scores, and standard deviations for verbal and quantitative aptitude tests by prospective field of graduate study and by year)

Prospective field of graduate study	Aptitude	1970-71			1971-72			1972-73			1973-74			1974-75			All years		
		Number	Mean	S.D.	Number	Mean	S.D.	Number	Mean	S.D.	Number	Mean	S.D.	Number	Mean	S.D.	Total no.	Mean	S.D.[1]
Science																			
Physical sciences	V	499	512	136	323	500	134	474	519	130	454	502	126	526	508	133	2,276	509	130
	Q		650	106		643	109		648	105		648	113		630	110		644	106
Mathematical sciences	V	415	517	141	248	495	135	362	510	131	404	513	139	384	506	126	1,813	509	136
	Q		675	104		673	91		675	96		675	97		661	104		672	99
Engineering	V	665	444	132	372	448	122	544	455	132	573	449	133	594	440	127	2,748	447	129
	Q		656	98		651	97		665	93		663	100		649	103		657	99
Life sciences	V	1,036	491	122	716	491	122	1,069	504	117	1,202	508	121	1,347	509	116	5,370	502	119
	Q		556	120		553	122		570	118		569	117		568	118		564	120
Basic social sciences	V	2,085	533	117	1,570	527	116	2,176	522	120	2,153	525	119	2,185	521	120	10,169	525	121
	Q		530	118		526	120		521	125		521	127		518	128		523	124
Nonscience																			
Health professions	V	358	500	114	256	502	108	376	509	107	471	508	113	597	502	103	2,058	504	110
	Q		496	119		501	117		508	120		507	120		513	119		506	120
Education	V	2,993	472	110	2,120	463	112	2,988	452	113	2,953	449	113	2,745	454	113	13,799	458	112
	Q		462	120		457	119		450	119		442	120		445	120		451	120
Arts and humanities	V	2,686	546	118	1,659	534	117	2,571	537	120	2,574	541	125	2,405	542	121	11,895	540	123
	Q		494	118		492	116		493	122		494	121		490	120		493	118
Applied social sciences	V	983	492	113	694	482	111	1,038	484	121	1,180	493	121	1,270	488	118	5,165	488	119
	Q		480	121		475	123		475	126		477	122		464	123		474	122
Other nonsciences	V	880	496	124	580	490	124	961	501	125	917	498	124	901	496	125	4,239	497	123
	Q		498	123		500	119		502	121		495	128		498	126		499	122

[1] Calculated by NSF, using formula S.D. $(X) = \sqrt{\frac{\Sigma_i\, [n_i \bar{x}_i^2 + (n_i - 1)s_i^2(x)] - N\bar{x}^2}{N-1}}$ where S.D. (x) = the standard deviation of the scores in a given field in a given test for the entire 5-year period; n_i = the number in the field in the ith year of the period; x_i = the mean score in the test of those in the field in the ith year; $s_i(x)$ = the standard deviation of the test scores of those in the field in the ith year; N = the total number in the field over the 5-year period; and x = the mean score of the entire group (N) in the test.

Note: V = Verbal, Q = Quantitative, and S.D. = Standard Deviation.

Sources: Educational Testing Service and National Science Foundation as appeared in National Science Foundation, *Science Resource Studies Highlights*, Sept. 26, 1977, p. 2.

Chapter V
DEGREE DATA

INTRODUCTION

A traditional measure of educational achievement is a degree. Patterns of degree earning derive from many influences: resources (Chap. I), individual desires and ability (Chaps. III and IV) and economic and social conditions, to list a few. In this chapter data are presented showing patterns in science degree earning at all levels.

The degrees data contained in this chapter are grouped into three categories: total number of earned degrees by subject and level, percent distribution of earned degrees by subject and level, and degree and distribution data for women and minorities.

HIGHLIGHTS

Earned Degrees

1. Between 1970 and 1976, the total number of associate degrees in science/engineering related occupational curricula increased by 87%. (Chart V-1)
2. While there are some exceptions, the total number of degrees awarded in most science disciplines peaked in the early 1970's and has now declined by as much as 48% as in the case for the bachelor's degree in mathematics. (Charts V-3 to 10)
3. In 1975-76, nearly three-fourths again as many bachelor's degrees were awarded in mathematics education as in science education. (Chart V-11)

Distribution

1. As a percent of total associate degree science/engineering related occupationa curricula grew by 30.2% between 1970 an 1976. (Chart V-2)
2. The number of science degrees as a percen of all degrees declined at all degree levels b tween 1964-65 and 1975-76. (Charts V-12 to 1

Women and Minorities

1. With a few exceptions, the number of scienc degrees at all levels earned by females ha steadily increased. (Charts V-15 to 17)
2. With one slight exception, women have i creased their share of science degrees i every discipline and at every level. (Chart V-18 to 20)
3. Minorities earn a greater percent o bachelor's degrees in the social science than in the natural sciences. (Chart V-21)

Chart V-1: Earned associate degrees science/engineering-related occupational curricula, 1970-71 to 1975-76

While the total number of degrees in science/engineering-related occupational curricula increased by 87%, degrees in data processing decreased by 5.1%.

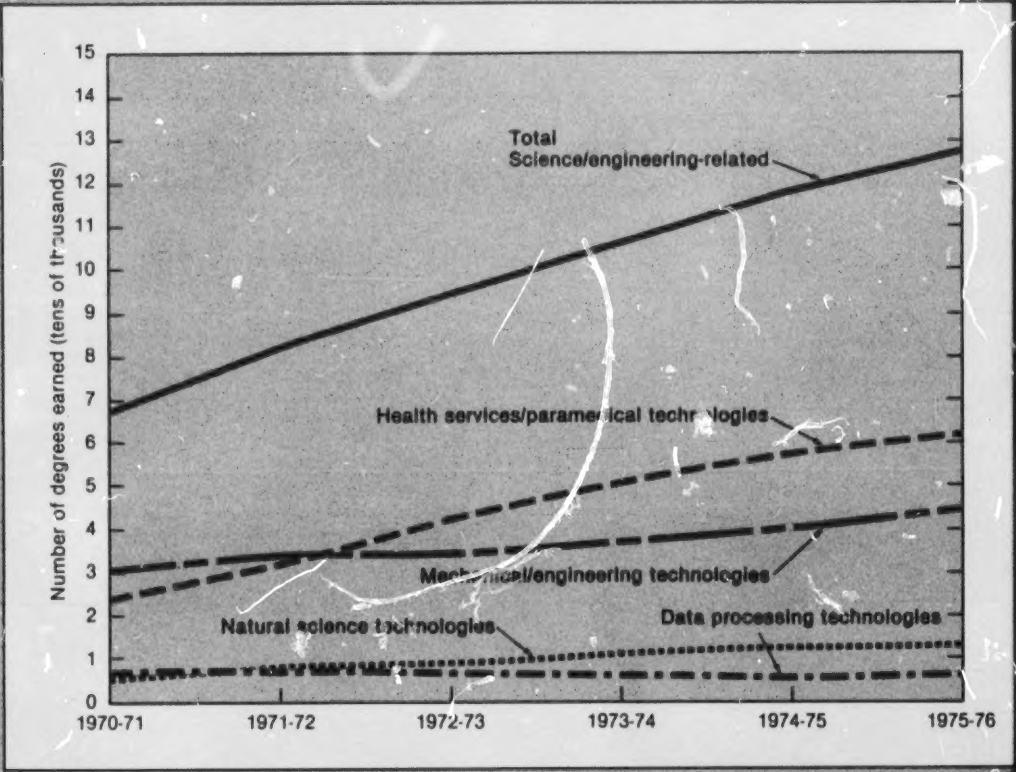


Table V-1: Earned associate[1] degrees in science/engineering-related occupational curricula, 1970-71 to 1975-76

Curriculum category and division	1970-71*	1971-72*	1972-73*	1973-74	1974-75	1975-76	Percent change 1970-71—1975-76
All curricula total	272,862	313,757	337,757	369,943	388,122	422,586	54.9
Occupational curricula							
Science/engineering-related	68,213	83,069	94,623	107,332	118,505	127,579	87.0
Data processing technologies	7,564	7,841	7,640	6,998	6,821	7,176	– 5.1
Health services/paramedical technologies	24,370	32,288	42,910	51,207	57,943	61,918	154.1
Mechanical/engineering technologies	30,172	34,546	34,781	37,631	40,775	45,169	49.7
Natural science technologies	6,107	8,394	9,292	11,496	12,966	13,316	118.0
All other curricula	204,649	230,690	243,134	262,611	269,617	295,007	44.2

*Does not include those below the technical or semiprofessional level.

[1] An associate degree is usually one granted for the first two years of formal academic study.

Source: Malitz, Gerald S., *Associate Degrees and Other Formal Awards Below the Baccalaureate: Analysis of 6-year Trends*, p. 8.

Chart V-2: Percent distribution of associate degrees, by curriculum category, 1970-71 to 1975-76

The percent of total degrees in science/engineering-related occupational curricula grew from 25% to 30.2%. Both health services and natural sciences showed increases while data processing and mechanical/engineering registered percentage declines.

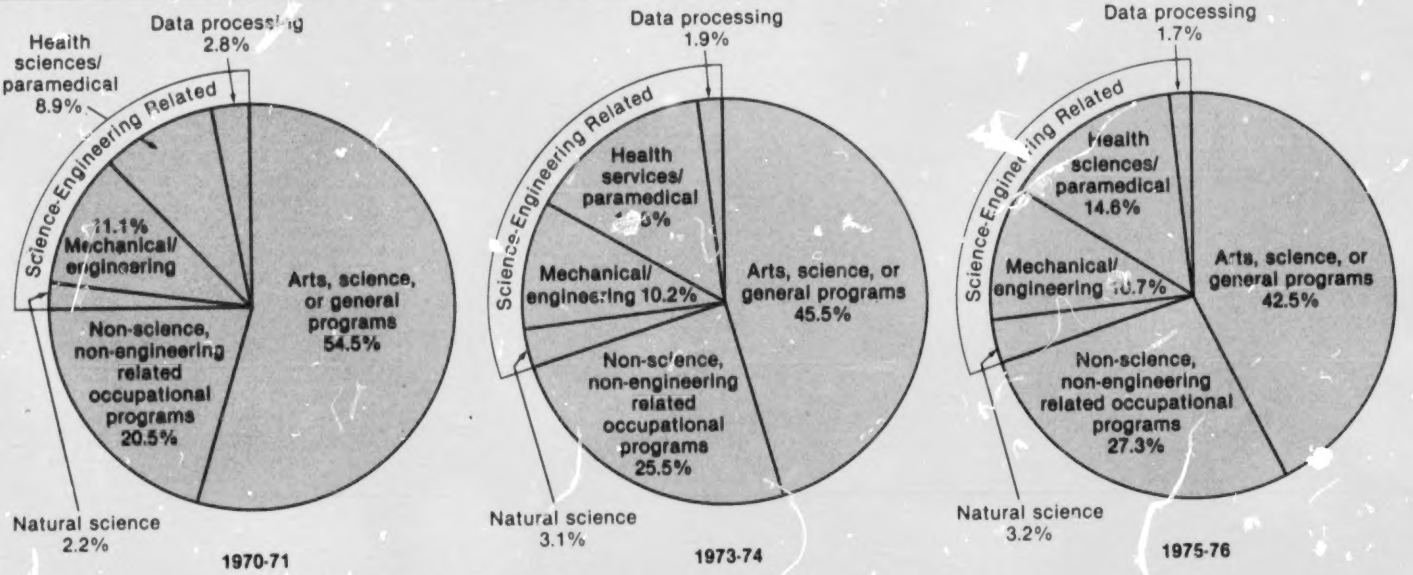


Table V-2: Percent distribution of associate degrees by curriculum category, 1970-71 — 1975-76

Curriculum category and division	1970-71	1971-72	1972-73	1973-74	1974-75	1975-76
All curricula, total	100.0	100.0	100.0	100.0	100.0	100.0
Arts and science or general programs	54.5	51.3	48.5	45.5	43.8	42.5
Occupational curricula	45.5	48.7	51.5	54.5	56.2	57.5
Science/engineering-related	25.0	26.5	28.0	29.0	30.5	30.2
Data processing technologies	2.8	2.5	2.3	1.9	1.8	1.7
Health services/paramedical technologies	8.9	10.3	12.7	13.8	14.9	14.6
Mechanical/engineering technologies	11.1	11.0	10.3	10.2	10.5	10.7
Natural science technologies	2.2	2.7	2.8	3.1	3.3	3.2
Nonscience/nonengineering-related	20.5	22.2	23.5	25.5	25.6	27.3
Business and commerce technologies	16.0	16.3	16.4	17.7	17.5	18.7
Public service-related technologies	4.5	5.9	7.2	7.8	8.1	8.6

Source: Malitz, Gerald S., *Associate Degrees and Other Formal Awards Below the Baccalaureate: Analysis of 6-year Trends*, p. 3.

Charts V-3, A&B: Earned degrees in the biological sciences, by level of degree, 1951-52 to 1976-77

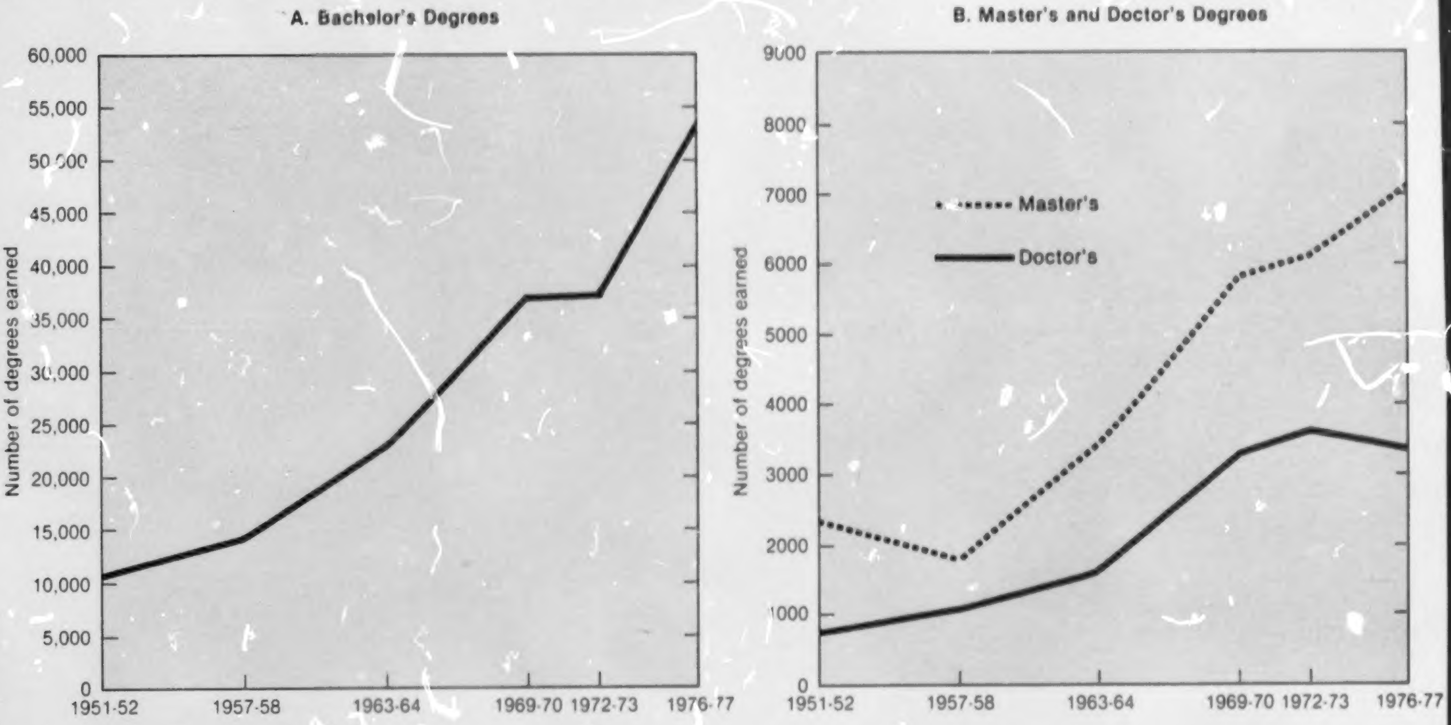


Table V-3: Earned degrees in the biological sciences[1] conferred by institutions of higher education, by level of degree and by sex of student: 1951-52 to 1976-77

Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1951-52	11,094	8,212	2,882	2,307	1,908	399	764	680	84
1953-54	9,279	6,710	2,569	1,610	1,287	323	1,077	977	100
1955-56	12,423	9,515	2,908	1,759	1,379	380	1,025	908	117
1957-58	14,308	11,159	3,149	1,852	1,448	404	1,125	987	138
1959-60	15,576	11,654	3,922	2,154	1,668	486	1,205	1,086	119
1961-62	16,915	12,136	4,779	2,642	1,982	660	1,338	1,179	159
1963-64	22,723	16,321	6,402	3,296	2,348	948	1,625	1,432	193
1965-66	26,916	19,368	7,548	4,232	3,085	1,147	2,097	1,792	305
1967-68	31,826	22,968	8,840	5,506	3,959	1,547	2,784	2,345	439
1969-70	37,389	27,004	10,385	5,800	3,975	1,825	3,289	2,820	469
1970-71	35,743	25,333	10,410	5,728	3,805	1,923	3,645	3,050	595
1971-72	37,293	26,323	10,970	6,101	4,087	2,014	3,653	3,031	622
1972-73	42,233	29,636	12,597	6,263	4,354	1,909	3,636	2,926	710
1973-74	48,340	33,245	15,095	6,552	4,555	1,997	3,439	2,740	699
1974-75	51,741	34,612	17,129	6,550	4,587	1,963	3,384	2,641	743
1975-76	54,275	35,420	18,755	6,582	4,497	2,085	3,392	2,663	729
1976-77	53,605	34,218	19,387	7,114	4,718	2,396	3,397	2,671	726

[1] Includes degrees in anatomy, bacteriology, biochemistry, biology, botany, entomology, physiology, zoology, and other biological sciences.

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, p. 122.

Charts V-4, A&B: Earned degrees in the physical sciences, by level of degree, 1951-52 to 1976-77

The number of bachelor's degrees declined somewhat in the early 1970's and rose to its highest point by 1976-77. The numbers of both master's and doctor's degrees have decreased since 1970-71: master's by 16% and doctor's by 24%.

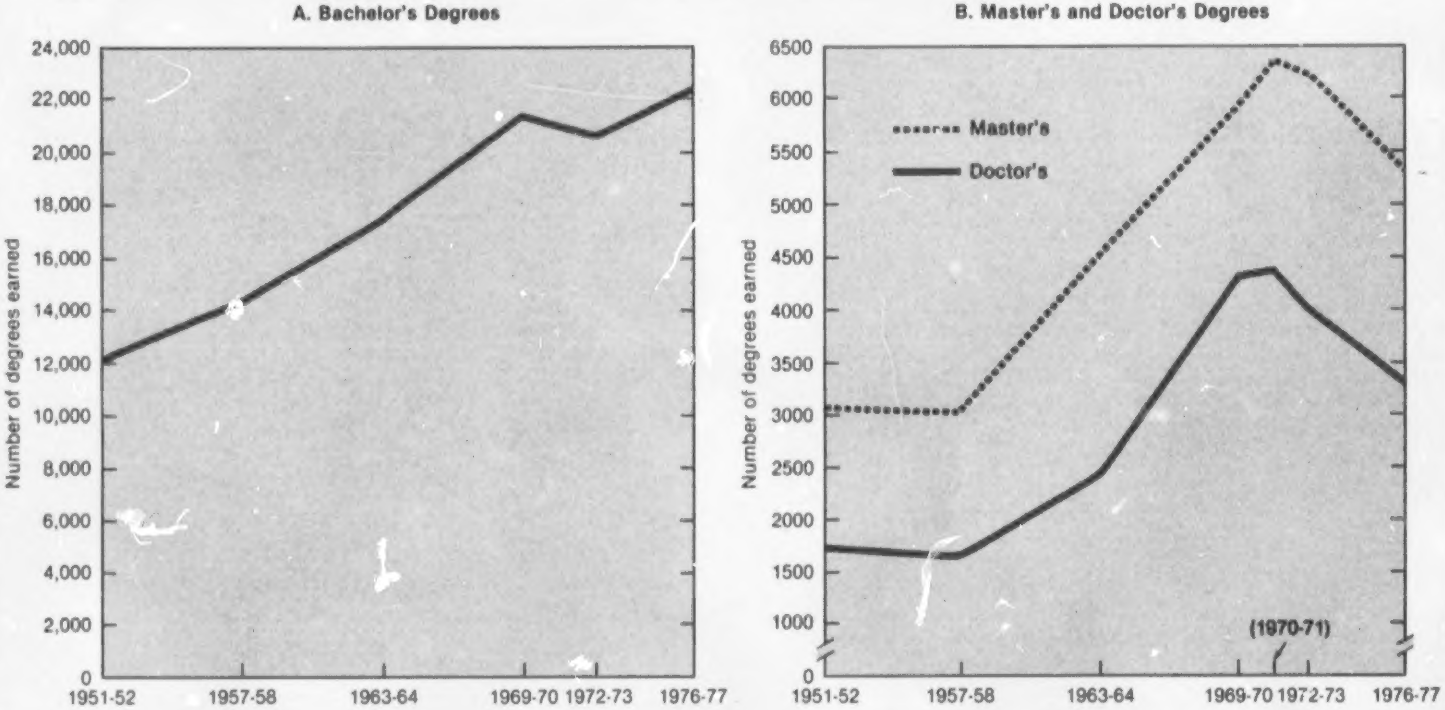


Table V-4: Earned degrees in the physical sciences[1] conferred by institutions of higher education, by level of degree and by sex of student: United States, 1951-52 to 1976-77

Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1951-52	12,118	10,799	1,319	3,054	2,830	244	1,720	1,663	57
1953-54	9,838	8,584	1,254	2,374	2,197	177	1,686	1,625	61
1955-56	11,629	10,140	1,484	2,655	2,435	220	1,667	1,599	68
1957-58	14,317	12,659	1,658	3,030	2,759	271	1,655	1,589	66
1959-60	16,007	14,013	1,994	3,376	3,049	327	1,828	1,776	62
1961-62	15,851	13,728	2,123	3,928	3,544	384	2,122	2,035	87
1963-64	17,456	15,044	2,412	4,561	4,155	406	2,455	2,342	113
1965-66	17,129	14,822	2,307	4,987	4,462	525	3,045	2,914	131
1967-68	19,380	16,739	2,641	5,499	4,869	630	3,593	3,405	188
1969-70	21,439	18,522	2,917	5,935	5,093	842	4,312	4,077	235
1970-71	21,412	18,459	2,953	6,367	5,521	846	4,390	9,144	246
1971-72	20,745	17,663	3,081	6,287	5,404	883	4,103	3,830	273
1972-73	20,606	17,626	3,070	6,257	5,414	843	4,006	3,738	268
1973-74	21,178	17,674	3,504	6,062	5,186	876	3,626	3,373	253
1974-75	20,778	16,992	3,786	5,807	4,969	838	3,626	3,325	301
1975-76	21,465	17,353	4,112	5,466	4,648	818	3,431	3,132	299
1976-77	22,497	17,996	4,501	5,331	4,450	881	3,341	3,022	319

[1] Includes degrees in astronomy, chemistry, geology, metallurgy, meteorology, physics, and other physical sciences.

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, p. 121.

Chart V-5: Earned degrees in physics, by level of degree 1951-52 to 1976-77

The numbers of master's and bachelor's degrees were greatest in 1969-70; the number of doctor's degrees greatest in 1970-71. The decline to 1976-77 was 35% for bachelor's degrees, 40% for master's, and 38% for doctor's.

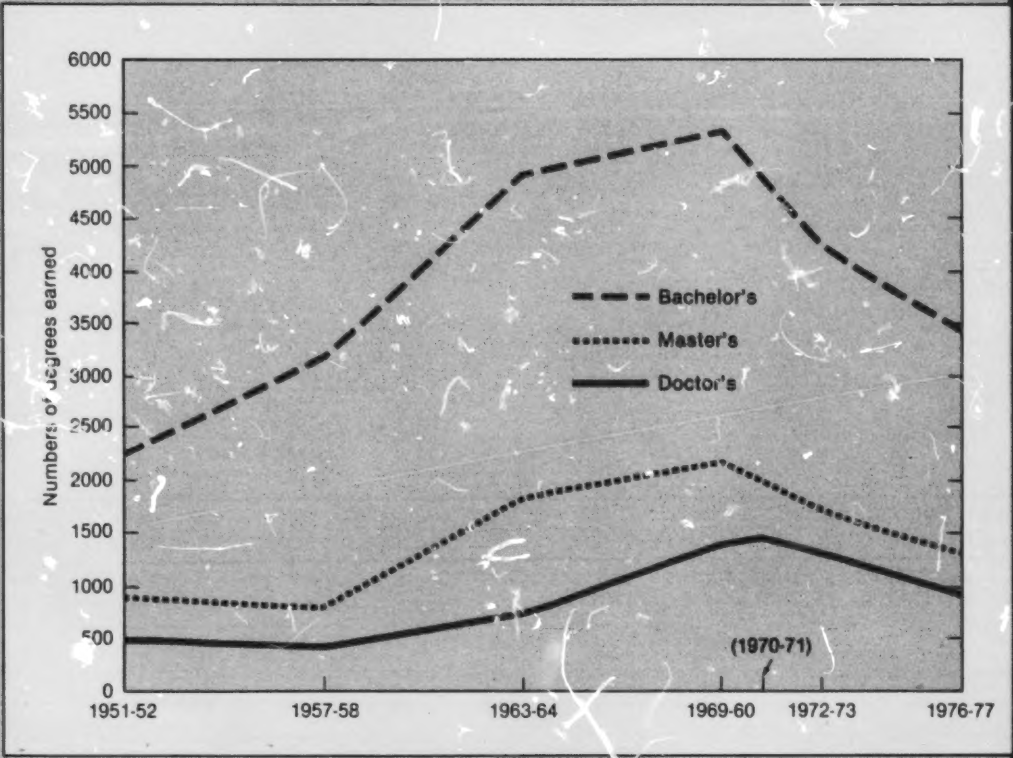


Table V-5: Earned degrees in physics conferred by institutions of higher education, by level of degree and by sex of student: United States, 1949-50 to 1976-77

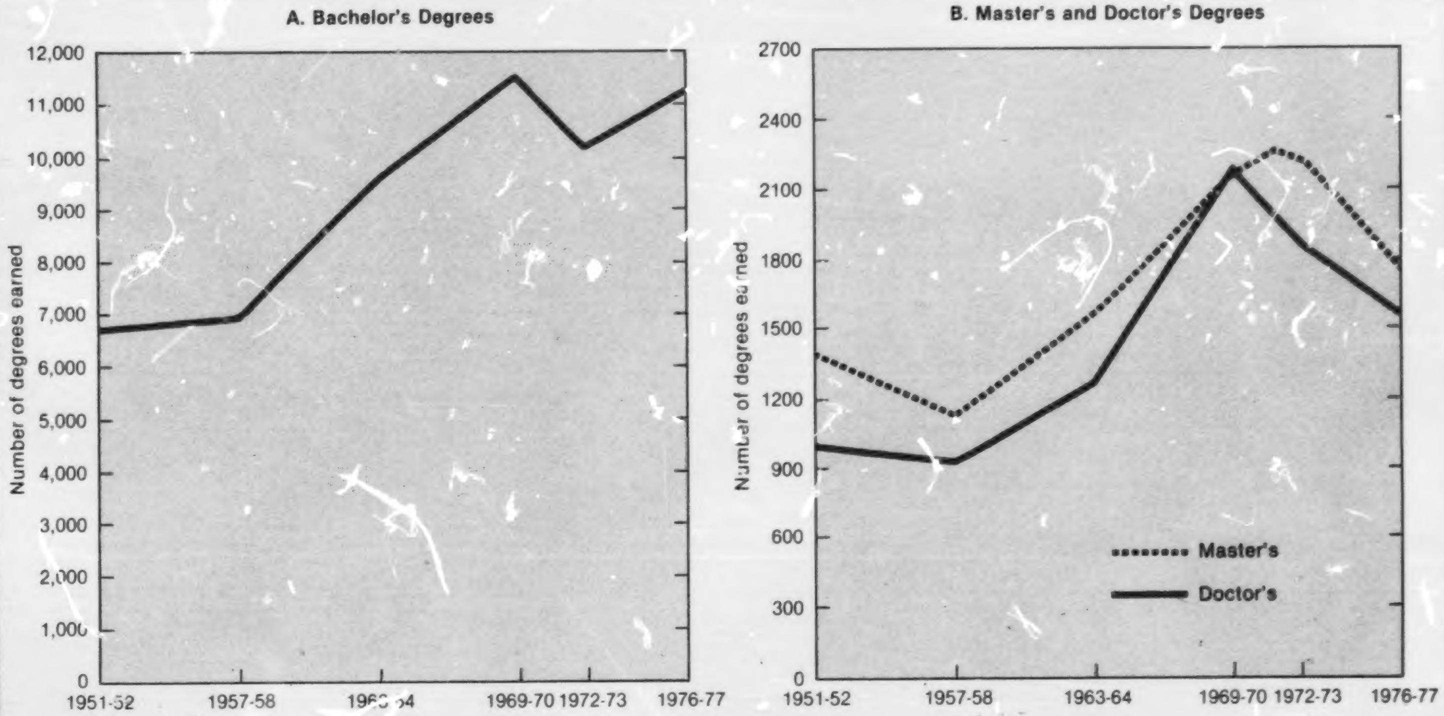
Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1949-50	3,413	3,286	127	922	888	34	358	353	5
1951-52	2,245	2,139	106	886	851	35	485	476	9
1953-54	1,949	1,874	75	714	685	29	485	479	6
1955-56	2,329	2,228	101	742	719	23	470	462	8
1957-58	3,179	3,038	141	795	770	25	464	455	9
1959-60	4,322	4,154	168	1,073	1,039	35	487	477	10
1961-62	4,808	4,620	188	1,425	1,363	62	667	655	12
1963-64	4,946	4,714	232	1,848	1,782	66	778	767	11
1965-66	4,601	4,378	223	1,949	1,869	80	973	952	21
1967-68	5,038	4,745	293	2,088	1,993	45	1,260	1,234	26
1969-70	5,320	4,993	327	2,200	2,043	157	1,439	1,402	37
1970-71	5,071	4,729	342	2,188	2,038	150	1,482	1,439	43
1971-72	4,634	4,314	320	2,033	1,874	159	1,344	1,301	43
1972-73	4,259	3,949	310	1,747	1,634	113	1,338	1,287	51
1973-74	3,952	3,618	334	1,655	1,520	135	1,115	1,068	43
1974-75	3,706	3,347	359	1,574	1,450	124	1,080	1,028	52
1975-76	3,544	3,156	388	1,451	1,319	132	997	952	45
1976-77	3,420	3,062	358	1,319	1,193	126	945	890	55

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, p. 121.

Charts V-6, A&B: Earned degrees in chemistry by level of degree, 1951-52 to 1976-77

The number of bachelor's degrees is approaching the peak reached in 1969-70, while the numbers of master's and doctor's degrees are declining since the early 1970's.



A. Bachelor's Degrees

B. Master's and Doctor's Degrees

Table V-6: Earned degrees in chemistry conferred by institutions of higher education, by level of degree and by sex of student: United States, 1949-50 to 1976-77

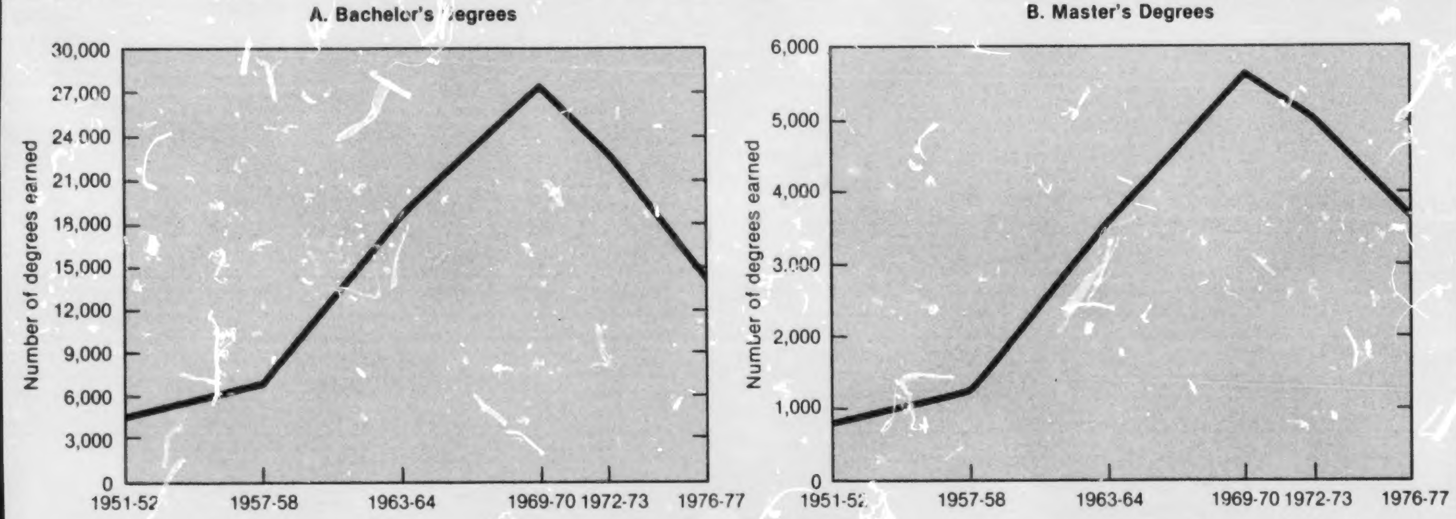
Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1949-50	10,597	9,121	1,476	1,576	1,368	208	953	914	39
1951-52	6,794	5,705	1,089	1,409	1,242	167	1,031	986	45
1953-54	5,752	4,707	1,045	1,098	972	126	1,013	968	45
1955-56	6,141	4,970	1,171	1,164	1,035	129	986	934	52
1957-58	6,982	5,685	1,297	1,125	958	167	939	890	49
1959-60	7,569	5,989	1,580	1,228	1,025	203	1,048	1,000	48
1961-62	8,047	6,355	1,692	1,401	1,162	239	1,114	1,045	69
1963-64	9,660	7,774	1,886	1,560	1,285	275	1,271	1,179	92
1965-66	9,687	7,911	1,776	1,817	1,470	347	1,533	1,442	91
1967-68	10,783	8,851	1,932	1,977	1,575	402	1,723	1,584	139
1969-70	11,519	9,453	2,066	2,111	1,638	473	2,166	2,000	166
1970-71	11,063	9,026	2,037	2,275	1,787	488	2,159	1,986	173
1971-72	10,590	8,533	2,057	2,248	1,748	500	1,971	1,778	193
1972-73	10,128	8,208	1,920	2,225	1,761	464	1,872	1,694	178
1973-74	10,438	8,353	2,085	2,125	1,661	464	1,823	1,650	173
1974-75	10,549	8,210	2,339	1,986	1,580	406	1,822	1,618	204
1975-76	11,022	8,550	2,472	1,783	1,406	377	1,621	1,425	196
1976-77	11,215	8,659	2,556	1,767	1,324	443	1,568	1,381	187

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, p. 120.

Chart V-7, A, B&C: Earned degrees in mathematics, by level of degree, 1951-52 to 1976-77

In 1969-70 at every level more mathematics degrees were earned than in any other year. Since then the decline in the numbers has been 48% for bachelor's, 34% for master's, and 33% for doctor's.



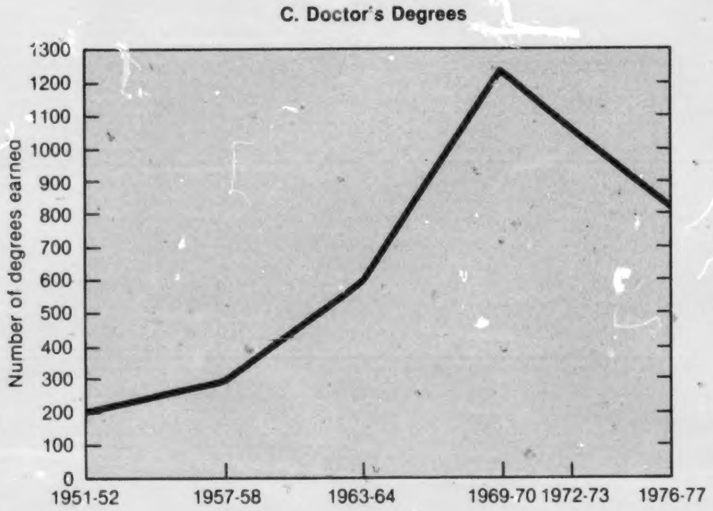


Table V-7: Earned degrees in mathematics[1] conferred by institutions of higher education, by level of degree and by sex of student: United States, 1949-50 to 1976-77

Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1949-50	6,382	4,942	1,440	974	784	190	160	151	9
1951-52	4,696	3,374	1,322	802	563	139	206	195	11
1953-54	4,078	2,717	1,361	706	579	127	227	213	14
1955-56	4,646	3,128	1,518	898	719	179	235	225	10
1957-58	6,905	4,943	1,962	1,234	994	240	247	232	15
1959-60	11,399	8,293	3,106	1,757	1,422	335	303	285	18
1961-62	14,570	10,331	4,239	2,680	2,179	501	396	372	24
1963-64	18,624	12,656	5,968	3,597	2,911	686	596	567	29
1965-66	19,977	13,326	6,651	4,769	3,769	1,000	782	725	57
1967-68	23,513	14,782	8,731	5,527	4,199	1,328	947	895	52
1969-70	27,442	17,177	10,265	5,636	3,966	1,670	1,236	1,140	96
1970-71	24,801	15,369	9,432	5,191	3,673	1,518	1,199	1,106	93
1971-72	23,713	14,454	9,259	5,198	3,655	1,543	1,128	1,039	89
1972-73	23,067	13,796	9,271	5,028	3,525	1,503	1,068	966	102
1973-74	21,635	12,791	8,844	4,834	3,337	1,497	1,031	931	100
1974-75	18,181	10,586	7,595	4,327	2,905	1,422	975	865	110
1975-76	15,984	9,475	6,509	3,857	2,547	1,310	856	762	94
1976-77	14,196	8,303	5,893	3,695	2,396	1,299	823	714	109

[1] Includes degrees conferred in statistics.

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, p. 120.

Chart V-2, A, B&C: Earned degrees in engineering by level of degree, 1951-52 to 1976-77

The number of bachelor's degrees appears to be approaching the peak reached in 1972-73. The number
master's degrees was highest in 1971-72 but the subsequent decline appears to have stabilized. Th
number of doctor's degrees has fallen steadily since 1969-70.

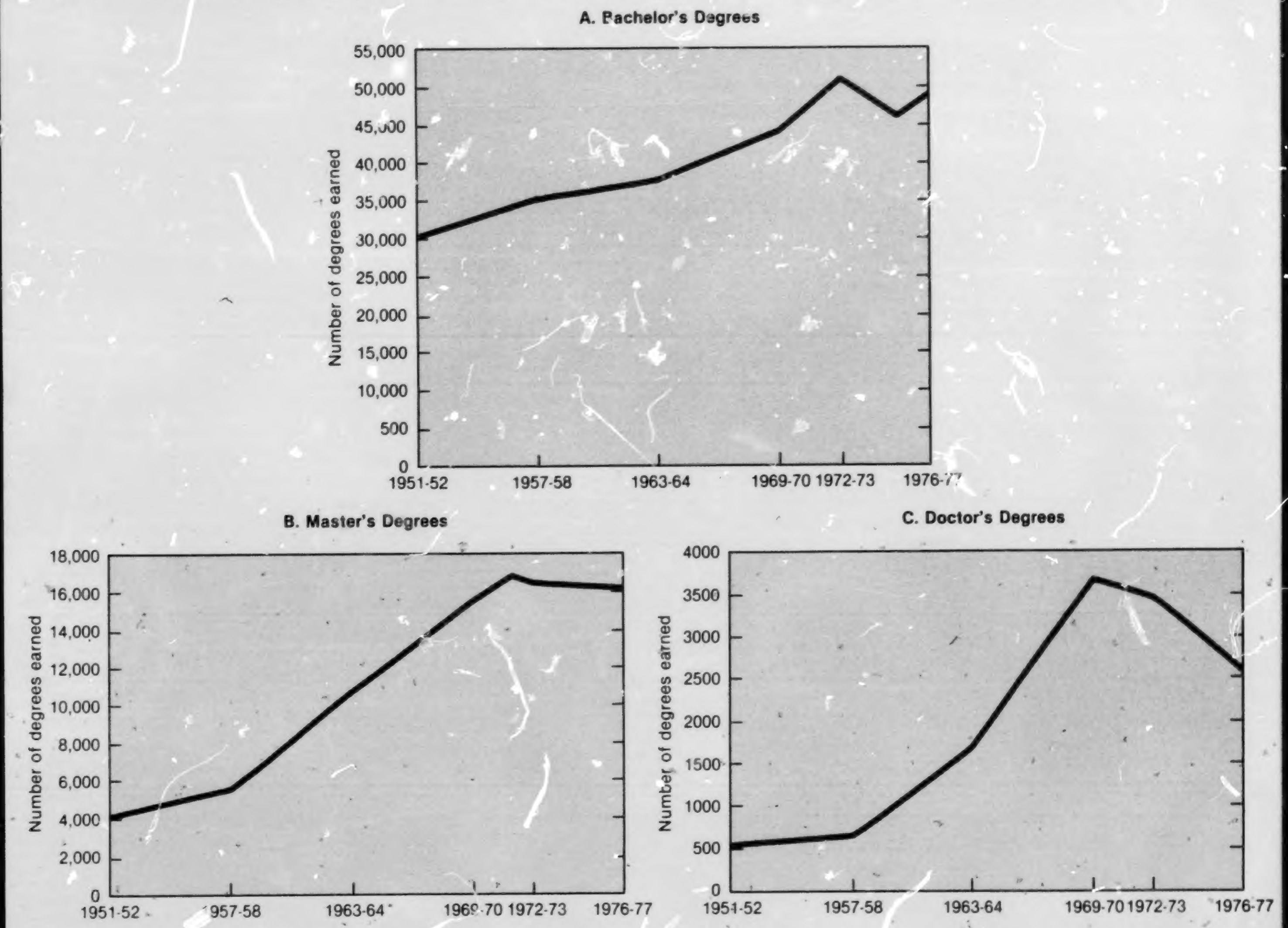


Table V-3: Earned degrees in engineering conferred by institutions of higher education, by level of degree and by sex of student: United States, 1949-50 to 1976-77

Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1949-50	52,246	52,071	175	4,496	4,481	15	417	416	1
1951-52	30,492	30,412	60	4,091	4,073	18	529	526	3
1953-54	22,227	22,163	65	4,204	4,189	15	594	594	—
1955-56	26,219	26,143	76	4,724	4,705	19	610	610	—
1957-58	35,191	35,082	109	[illegible]	5,768	20	647	643	4
1959-60	37,679	37,537	142	[illegible]	7,133	26	786	783	3
1961-62	34,551	34,430	121	8,909	8,869	40	1,207	1,203	4
1963-64	36,013	34,862	151	10,827	10,793	34	1,693	1,686	7
1965-66	35,615	35,472	143	13,675	13,599	76	2,304	2,295	9
1967-68	37,368	37,159	209	15,182	15,083	99	2,932	2,920	12
1969-70	44,479	44,149	330	15,593	15,421	172	3,681	3,657	24
1970-71	50,046	49,646	400	16,443	16,358	185	3,638	3,615	23
1971-72	51,164	50,638	526	16,960	16,688	272	3,671	3,649	22
1972-73	51,265	50,652	613	16,619	16,341	278	3,492	3,438	54
1973-74	50,286	49,490	796	15,379	15,023	356	3,312	3,257	55
1974-75	46,852	45,838	1,014	15,348	14,973	375	3,108	3,042	66
1975-76	46,331	44,871	1,460	16,342	15,760	582	2,821	2,755	66
1976-77	49,283	47,065	2,218	16,245	15,525	720	2,586	2,513	73

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics 1979*, p. 122.

Chart V-9, A&B: Earned degrees in psychology, by level of degree, 1951-52 to 1976-77

While since 1973-74 there has been a decline in the number of bachelor's degrees granted, the numbers of master's and doctor's have continued to increase.

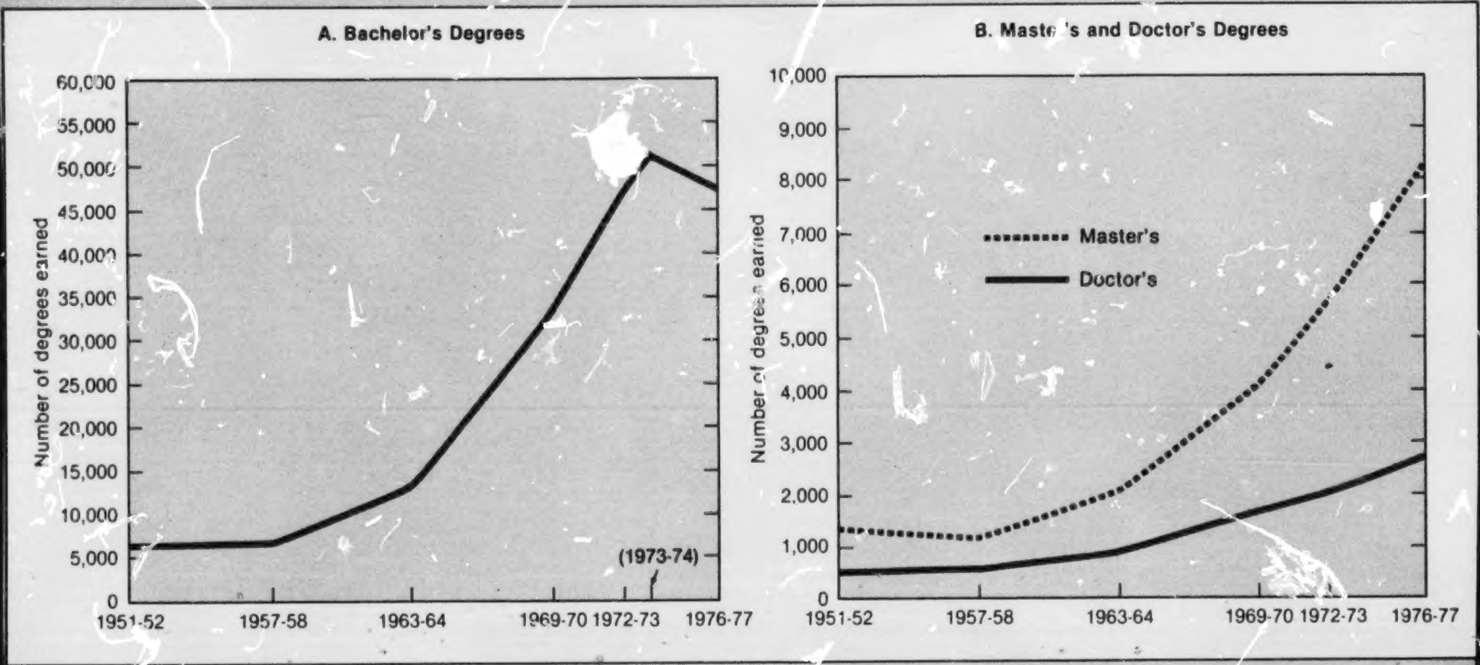


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Table V-9: Earned degrees in psychology conferred by institutions of higher education, by level of degree and by sex of student: United States, 1949-50 to 1976-77

Year	Bachelor's Degrees			Master's degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1949-50	9,569	6,055	3,514	1,316	948	368	283	241	42
1951-52	6,591	3,775	2,816	1,406	1,068	340	540	467	73
1953-54	5,706	3,074	2,632	1,254	885	369	619	553	66
1955-56	5,601	3,082	2,519	973	690	283	634	548	86
1957-58	6,867	4,038	2,829	1,235	836	399	572	488	84
1959-60	8,061	4,773	3,288	1,406	981	425	641	544	97
1961-62	9,578	5,798	3,780	1,832	1,269	563	781	632	149
1963-64	13,258	7,817	5,441	2,059	1,371	688	939	757	182
1965-66	16,897	10,002	6,895	2,530	1,680	850	1,046	826	220
1967-68	23,819	13,792	10,027	3,479	2,321	1,158	1,268	982	286
1969-70	33,606	19,042	14,564	4,111	2,549	1,562	1,668	1,296	372
1970-71	37,880	21,029	16,851	4,431	2,783	1,648	1,782	1,355	427
1971-72	43,093	23,159	19,934	5,289	3,259	2,030	1,881	1,414	467
1972-73	47,695	24,976	22,719	5,831	3,495	2,336	2,089	1,484	605
1973-74	51,821	25,705	26,116	6,588	3,971	2,617	2,336	1,645	691
1974-75	50,988	24,190	26,798	7,066	4,044	3,022	2,442	1,688	754
1975-76	49,908	22,832	27,076	7,811	4,171	3,640	2,581	1,762	819
1976-77	47,794	20,692	27,102	8,320	4,316	4,004	2,761	1,770	991

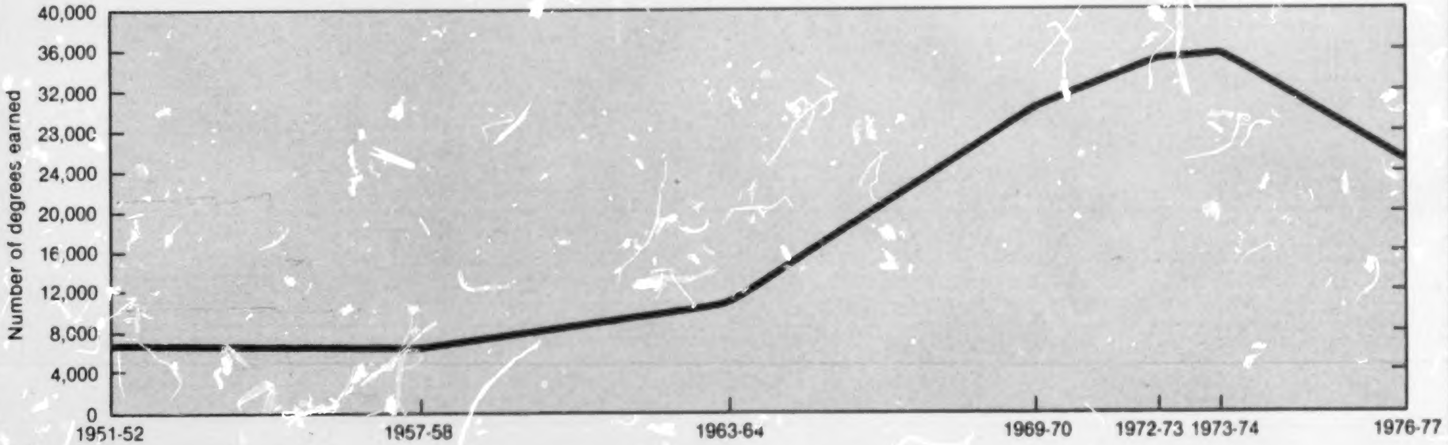
NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1977-78*, p. 119, and U.S. Department of Health, Education, and Welfare, National Center for Education Statistics, reports on *Earned Degrees Conferred*.

Chart V-10, A&B: Earned degrees in sociology, by level of degree, 1951-52 to 1976-77

The numbers of both bachelor's and master's degrees have declined since 1973-74, by 22% and 9% respectively. The number of doctor's degrees appears to be declining slightly.

A. Bachelor's Degrees



B. Master's and Doctor's Degrees

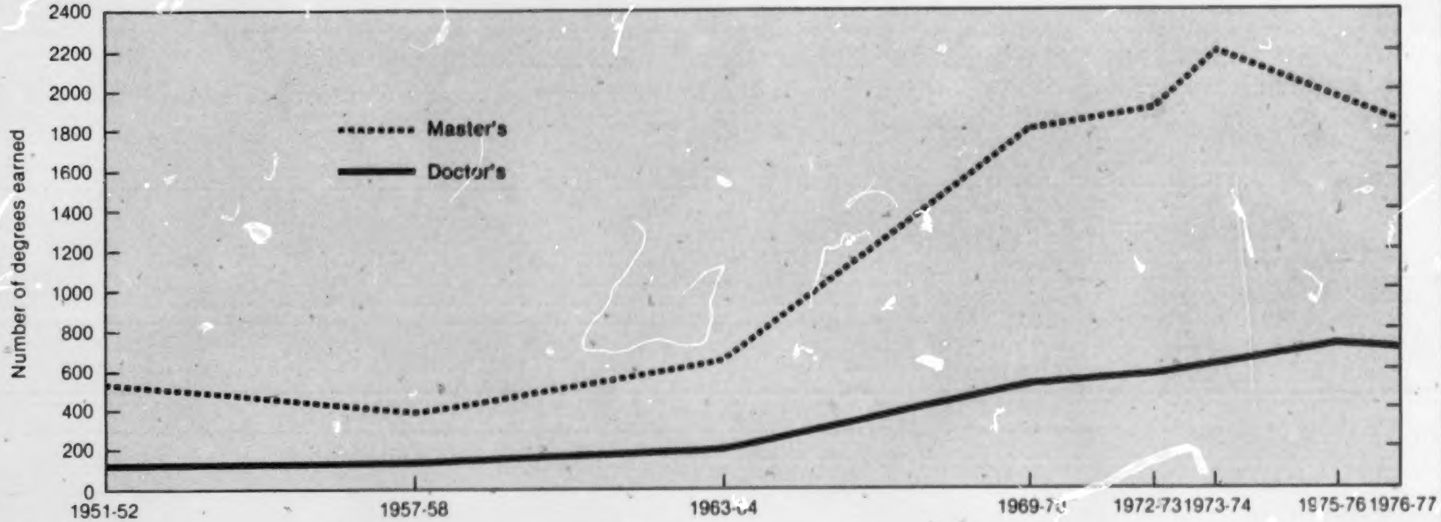


Table V-10: Earned degrees in sociology conferred by institutions of higher education, by level of degree and by sex of student: United States, 1949-50 to 1976-77

Year	Bachelor's Degrees			Master's Degrees			Doctor's Degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
1	2	3	4	5	6	7	8	9	10
1949-50	7,870	3,837	4,033	552	373	179	98	80	18
1951-52	6,648	2,967	3,681	517	386	131	141	121	20
1953-54	5,692	2,383	3,309	440	323	117	184	156	28
1955-56	5,878	2,535	3,343	402	275	127	170	141	29
1957-58	6,568	2,972	3,596	397	258	139	150	122	28
1959-60	7,147	3,162	3,985	440	327	113	161	135	26
1961-62	8,120	3,606	4,514	578	422	156	173	147	26
1963-64	10,943	4,437	6,506	646	466	180	198	169	29
1965-66	15,038	6,104	8,934	981	680	301	244	208	36
1967-68	21,710	8,469	13,241	1,193	790	403	367	299	68
1969-70	30,436	12,362	18,074	1,813	1,138	675	534	430	104
1970-71	33,263	13,610	19,653	1,808	1,131	677	574	455	119
1971-72	35,216	15,231	19,985	1,944	1,191	753	636	500	136
1972-73	35,436	15,580	19,856	1,923	1,146	777	583	429	154
1973-74	35,491	15,199	20,292	2,196	1,327	869	632	455	177
1974-75	31,488	13,209	18,279	2,112	1,304	808	693	484	209
1975-76	27,634	11,245	16,389	2,009	1,165	844	729	511	218
1976-77	24,989	9,802	15,187	1,830	1,018	812	714	480	234

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1977-78*, p. 118 and U.S. Department of Health, Education, and Welfare, National Center for Education Statistics, reports on *Earned Degrees Conferred*.

Chart V-11: Earned degrees in mathematics and science education, by level of degree and by sex, 1975-76

There were almost three-fourths again as many bachelor's degrees in mathematics education as science education, although the number of degrees at the higher levels were comparable. Women obtain more degrees in mathematics education at the bachelor's and master's levels than men. Men achieve more degrees in science education at all levels.

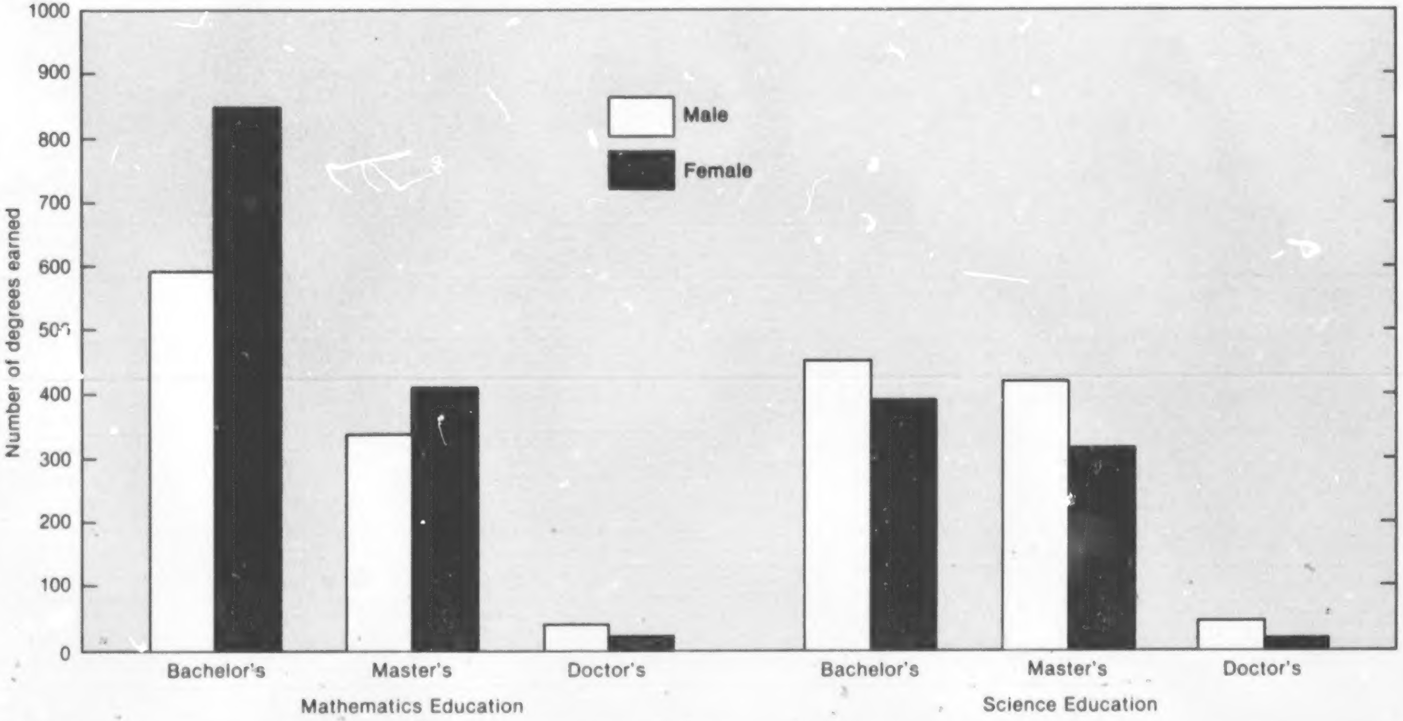


Table V-11: Earned degrees in mathematics and science education, by level of degree and sex, 1975-76

Type	Bachelor's degrees			Master's degrees			Doctor's degrees		
	Total	Men	Women	Total	Men	Women	Total	Men	Women
Mathematics education	1442	594	848	747	336	411	55	35	20
Science education	842	451	391	737	421	316	57	42	15

Source: U.S. Department of Health, Education and Welfare, National Center for Education Statistics, *Earned Degrees Conferred, 1975-76, Summary Data*, p. 17.

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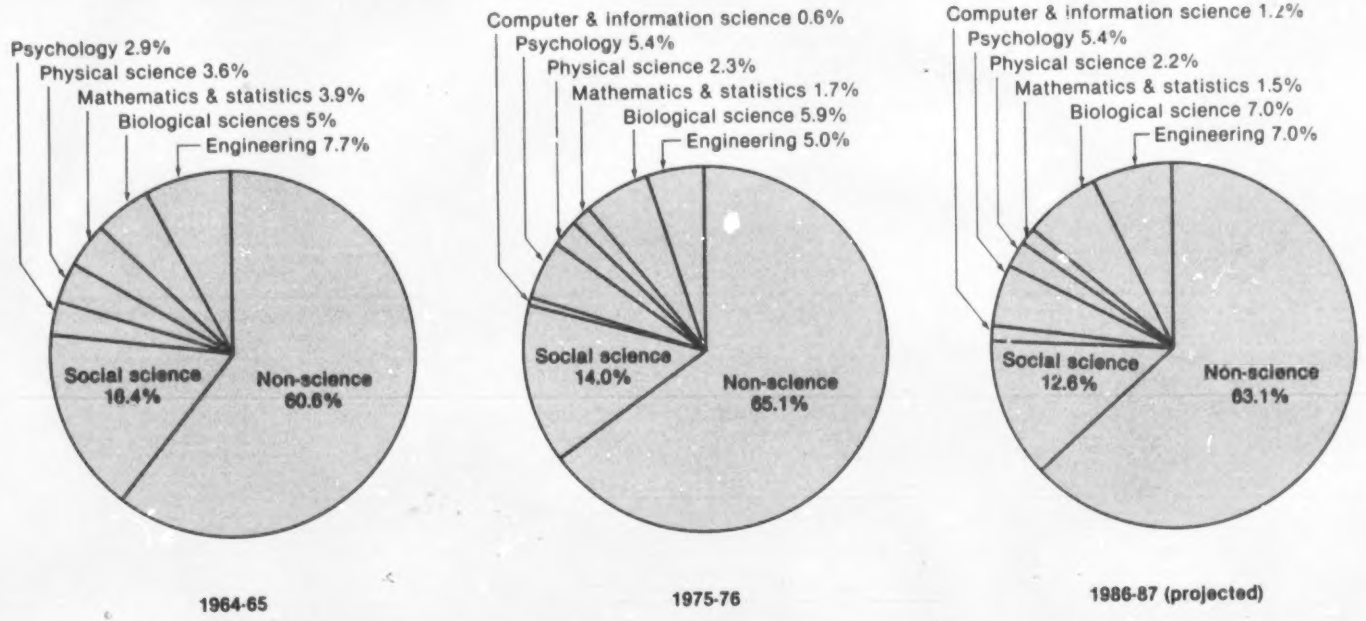
Chart V-12: Percent distribution of earned bachelor's degrees by field, 1964-65 to 1986-87

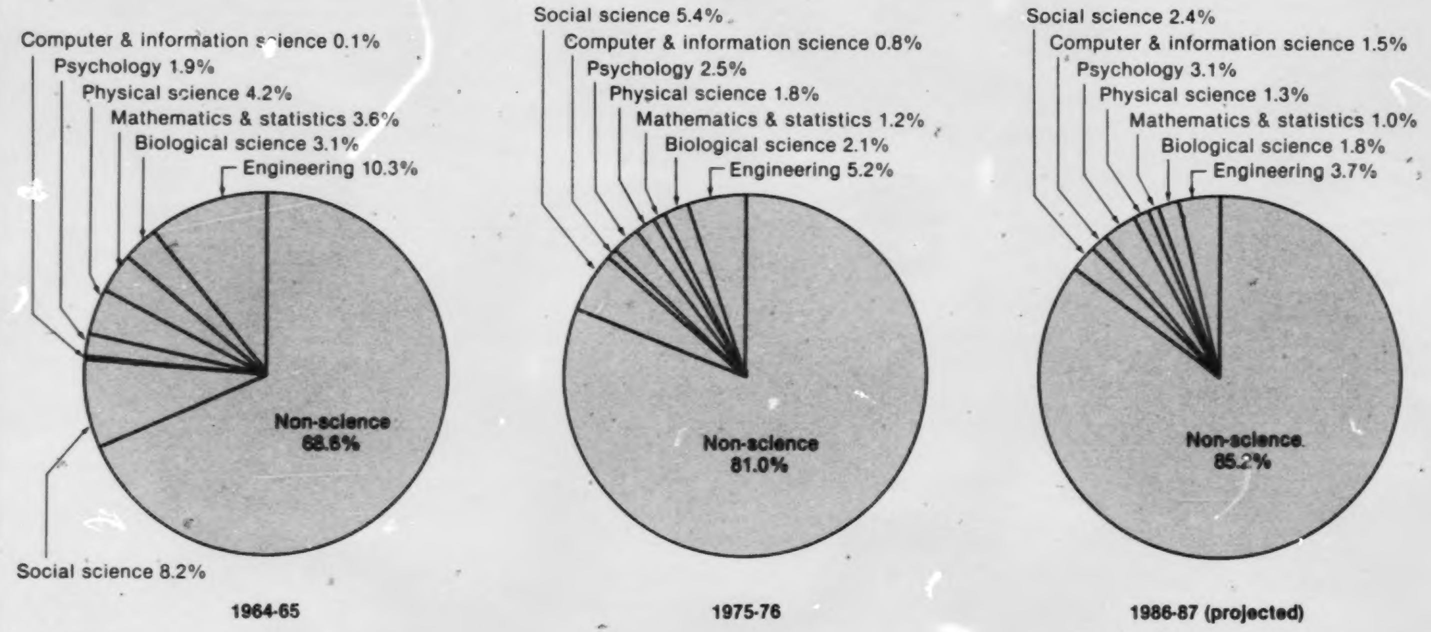
The most significant trend in the percent distribution of bachelor's degrees is the projected 61.5% decrease in mathematics and statistics between 1964-65 and 1986-87 and the rise of computer and information science as a discipline.



1964-65 1975-76 1986-87 (projected)

Chart V-13: Percent distribution of earned master's degrees by field, 1964-65 to 1986-87

The most significant trend in the percent distribution of master's degrees in the sciences is their overal decline, 31% between 1964-65 and 1975-76 and a further projected decline of 22% by 1986-87. Thi decline will affect nearly every area of science.



1964-65 **1975-76** **1986-87 (projected)**

Chart V-14: Percent distribution of earned doctor's degrees by field, 1964-65 to 1986-87

The most significant trend in the percent distribution of doctor's degrees in the sciences is their overal decline, 16.7% between 1964-65 and 1975-76 and a further projected decline of 10% by 1986-87. Thi decline is led by physical sciences, engineering, and mathematics and statistics.

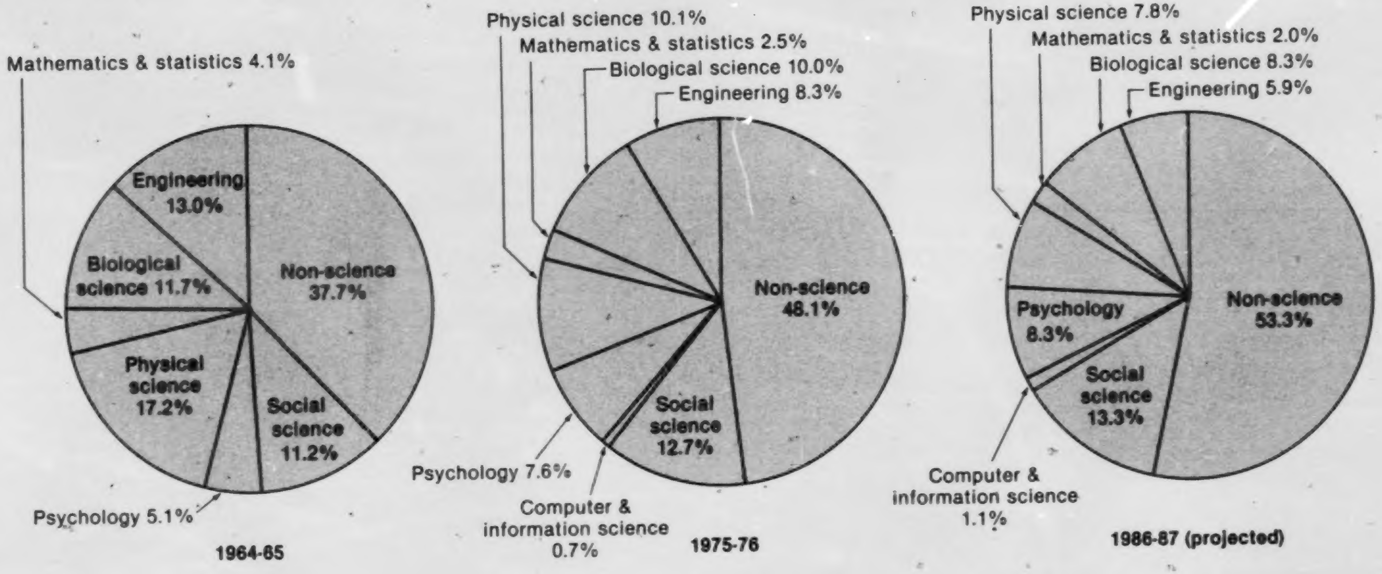


Table V-12, 13, 14: Percent distribution of earned degrees, by field of study and level: 1964-65 to 1986-87

	A. Social sciences					B. Humanities				
Year (1)	Total social sciences (2)	Social science (3)	Psychology (4)	Public affairs and services (5)	Library science (6)	Total humanities (7)	Architecture and environmental design (8)	Fine and applied arts (9)	Foreign language (10)	Communications (11)
Bachelor's										
1964-65	19.8	16.4	2.9	0.4	0.1	16.0	0.5	3.5	2.8	0.6
1975-76	23.1	14.0	5.4	3.6	0.1	15.1	1.0	4.6	1.7	2.3
1986-87	22.8	12.6	5.4	4.7	0.1	13.8	1.2	5.6	1.2	3.1
Master's										
1964-65	16.0	8.2	1.9	3.1	2.7	12.1	0.3	3.6	2.3	0.3
1975-76	16.0	5.4	2.5	5.5	2.6	9.6	1.0	2.8	1.1	1.0
1986-87	13.8	2.4	3.1	6.1	2.2	9.2	1.4	2.6	0.9	1.5
Doctor's										
1964-65	16.9	11.2	5.1	0.5	0.1	11.2	0.1	2.6	2.3	0.1
1975-76	21.5	12.7	7.6	0.9	0.2	12.4	0.2	1.8	2.5	0.6
1986-87	22.9	13.3	8.3	1.0	0.2	11.8	0.4	1.4	2.8	0.9

Table V-12, 13, 14: Percent distribution of earned degrees, by field of study and level: 1964-65 to 1986-87 (cont.)

	C. Natural sciences and miscellaneous fields										
Year (1)	Total natural sciences and miscellaneous fields (2)	Mathematics and statistics (3)	Computer and information sciences (4)	Engineering (5)	Physical sciences (6)	Biological sciences (7)	Agriculture and natural resources (8)	Health professions (9)	Accounting (10)	Business and management (11)	Education (12)
						Bachelor's					
1964-65	64.2	3.9	(¹)	7.7	3.6	5.0	1.5	3.1	3.0	9.6	23.2
1975-76	61.8	1.7	0.6	5.0	2.3	5.9	2.1	5.8	3.9	11.6	16.7
1986-87	63.4	1.5	1.2	7.0	2.2	7.0	2.2	7.8	4.1	11.8	11.9
						Master's					
1964-65	71.9	3.6	0.1	10.3	4.2	3.1	1.4	2.1	0.5	6.0	37.0
1975-76	74.4	1.2	0.8	5.2	1.8	2.1	1.1	4.0	0.9	12.8	41.0
1986-87	77.0	1.0	1.5	3.7	1.3	1.8	1.0	5.1	0.9	14.6	42.8
						Doctor's					
1964-65	71.9	4.1	(¹)	13.0	17.2	11.7	4.0	1.0	0.2	1.8	16.3
1975-76	66.1	2.5	0.7	8.3	10.1	10.0	2.7	1.7	0.2	2.6	22.8
1986-87	65.3	2.0	1.1	5.9	7.8	8.3	1.9	2.1	0.1	3.1	27.6

¹Data not available

NOTE: Data are for 50 States and the District of Columbia for all years. Because of rounding, details may not add to totals.

Source: Frankel, Martin M., *Projections of Education Statistics to 1986-87*, pp. 40-41.

Chart V-15: Bachelor's degrees in science earned by women, 1951-52 to 1975-76

Except in sociology and mathematics, women have steadily increased their number of bachelor's degrees in science.

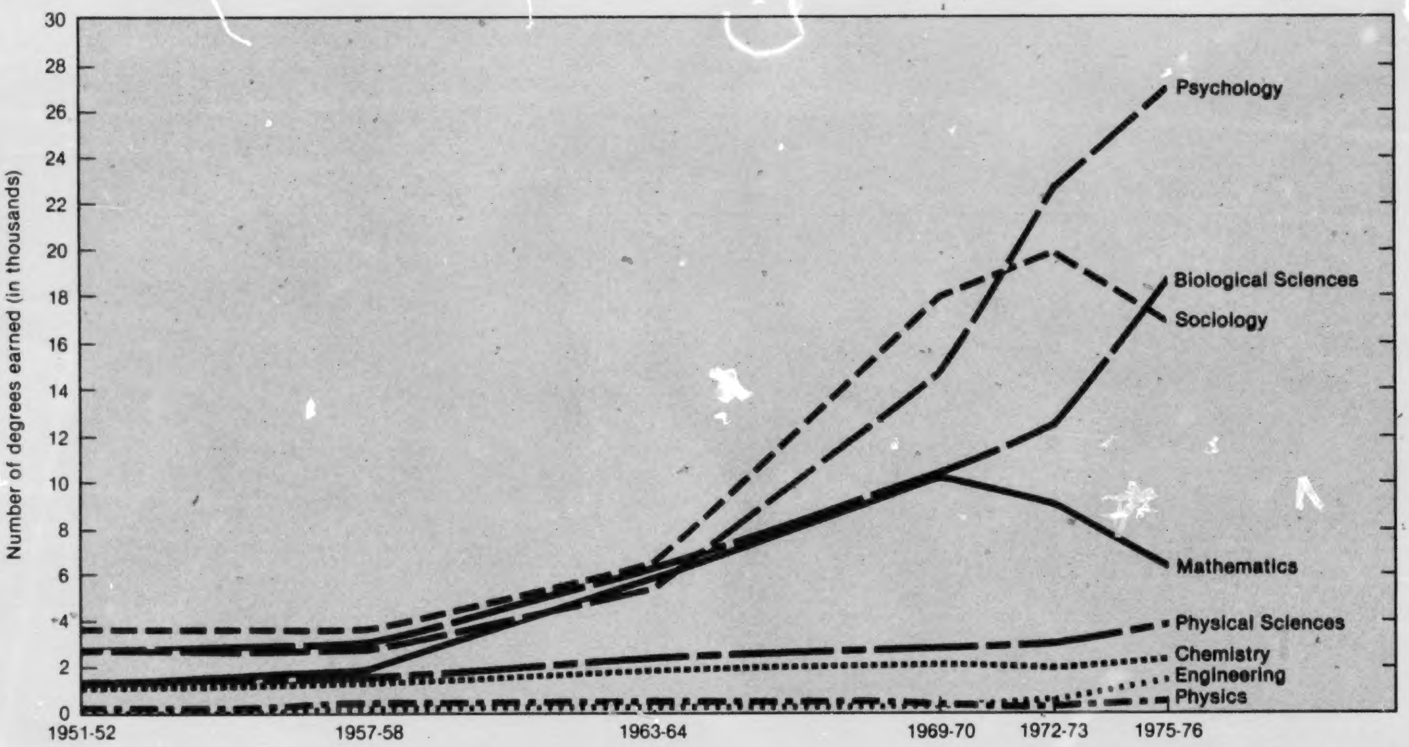


Table V-15: Bachelor's degrees in science earned by women, 1951-52 to 1976-77

Year	Psychology	Biological sciences[1]	Sociology	Mathematics[2]	Physical sciences[3]	Chemistry	Engineering	Physics
1951-52	2,816	2,882	3,681	1,322	1,319	1,089	60	106
1953-54	2,632	2,569	3,309	1,361	1,254	1,045	65	75
1955-56	2,519	2,908	3,343	1,518	1,484	1,171	76	101
1957-58	2,829	3,149	3,596	1,962	1,658	1,297	109	141
1959-60	3,288	3,922	3,985	3,106	1,994	1,580	142	168
1961-62	3,780	4,779	4,514	4,239	2,123	1,692	121	188
1963-64	5,441	6,402	6,506	5,968	2,412	1,886	151	232
1965-66	6,895	7,548	8,934	6,651	2,307	1,776	143	223
1967-68	10,027	8,840	13,241	8,731	2,641	1,932	209	293
1969-70	14,564	10,385	18,074	10,265	2,917	2,066	330	327
1970-71	16,851	10,410	19,653	9,432	2,953	2,037	400	342
1971-72	19,934	10,970	19,985	9,259	3,081	2,057	526	320
1972-73	22,719	12,597	19,856	9,271	3,070	1,920	613	310
1973-74	26,116	15,095	20,292	8,844	3,504	2,085	796	334
1974-75	26,798	17,129	18,279	7,595	3,786	2,339	1,014	359
1975-76	27,076	18,755	16,389	6,509	4,112	2,472	1,460	388
1976-77	27,102	19,387	15,187	5,893	4,501	2,556	2,218	358

[1] Includes degrees in anatomy, bacteriology, biochemistry, biology, botany, entomology, physiology, zoology, and other biological sciences.

[2] Includes degrees conferred in statistics.

[3] Includes degrees in astronomy, chemistry, geology, metallurgy, meterology, physics, and other physical sciences.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, pp. 120-22, *1977-78*, pp. 118-19, and U.S. Department of Health, Education and Welfare, National Center for Education Statistics, reports on *Earned Degrees Conferred.*

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Chart V-16: Master's degrees in science earned by women, 1951-52 to 1975-76

Except in mathematics, chemistry, and physics, women have steadily increased their number of master's degrees in science.

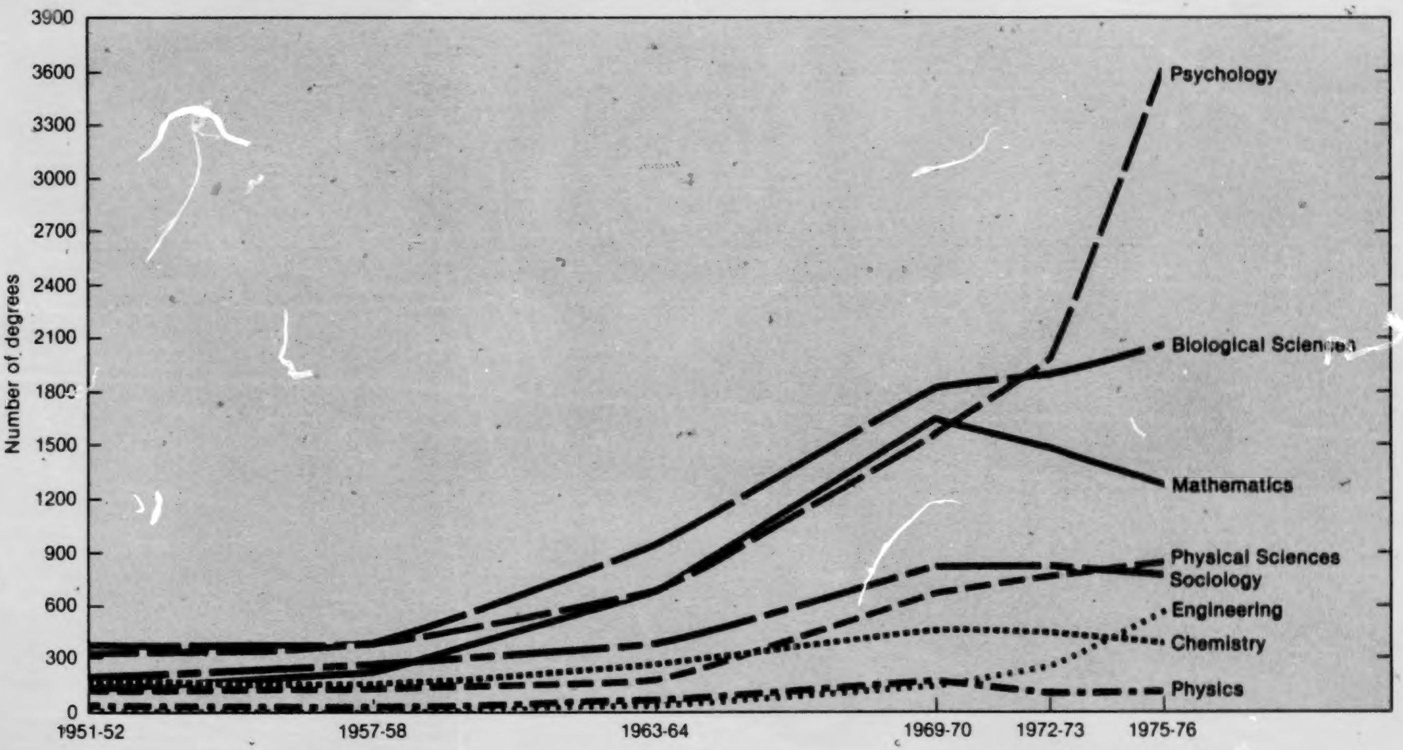


Table V-16: Master's degrees in science earned by women, 1951-52 to 1976-77

Year	Psychology	Biological sciences[1]	Sociology	Mathematics[2]	Physical sciences[3]	Chemistry	Engineering	Physics
1951-52	340	399	131	139	224	167	18	35
1953-54	369	323	117	127	177	126	15	29
1955-56	283	380	127	179	220	129	19	23
1957-58	399	404	139	240	271	167	20	25
1959-60	425	486	113	335	327	203	26	35
1961-62	563	660	156	501	384	239	40	62
1963-64	688	948	180	686	406	275	34	66
1965-66	850	1,147	301	1,000	525	347	76	80
1967-68	1,158	1,547	403	1,328	630	402	99	45
1969-70	1,562	1,825	675	1,670	842	473	172	157
1970-71	1,648	1,923	677	1,518	846	488	185	150
1971-72	2,030	2,014	753	1,543	883	500	272	159
1972-73	2,336	1,909	777	1,503	843	464	278	113
1973-74	2,617	1,997	869	1,497	876	464	356	135
1974-75	3,022	1,963	808	1,422	838	406	375	124
1975-76	3,640	2,085	814	1,310	818	377	582	132
1976-77	4,004	2,396	812	1,299	818	443	720	126

[1] Includes degrees in anatomy, bacteriology, biochemistry, biology, botany, entomology, physiology, zoology, and other biological sciences.

[2] Includes degrees conferred in statistics.

[3] Includes degrees in astronomy, chemistry, geology, metallurgy, meterology, physics, and other physical sciences.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, pp. 120-22, *1977-78*, pp. 118-19, and U.S. Department of Health, Education and Welfare, National Center for Education Statistics, reports on *Earned Degrees Conferred.*

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first-professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Chart V-17: Doctor's degrees in science earned by women, 1951-52 to 1975-76

Women have steadily increased their number of doctor's degrees in all areas of science.

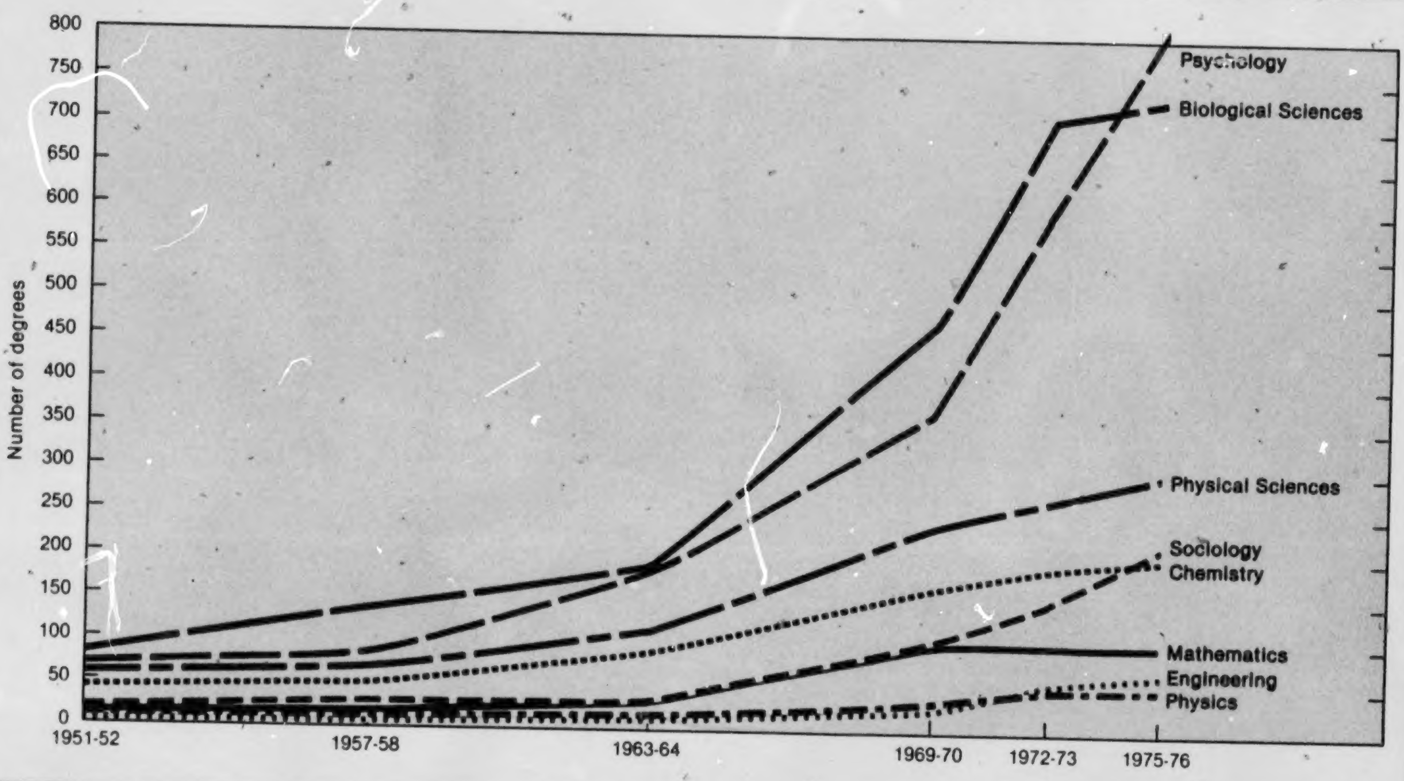


Table V-17: Doctor's degrees in science earned by women, 1951-52 to 1978-77

Year	Psychology	Biological sciences[1]	Sociology	Mathematics[2]	Physical sciences[3]	Chemistry	Engineering	Physics
1951-52	73	84	20	11	57	45	3	9
1953-54	66	100	28	14	61	45	—	6
1955-56	86	117	29	10	68	52	—	8
1957-58	84	138	28	15	66	49	4	9
1959-60	97	119	26	18	62	48	3	10
1961-62	149	159	26	24	87	69	4	12
1963-64	182	193	29	29	113	92	7	11
1965-66	220	305	36	57	131	91	9	21
1967-68	286	439	68	52	188	139	12	26
1969-70	372	469	104	96	235	166	24	37
1970-71	427	595	119	93	246	173	23	43
1971-72	467	622	136	89	273	193	22	43
1972-73	605	710	154	102	268	178	54	51
1973-74	691	699	177	100	253	173	55	49
1974-75	754	743	209	110	301	204	66	52
1975-76	819	729	218	94	299	196	66	45
1976-77	991	726	234	109	319	187	73	55

[1] Includes degrees in anatomy, bacteriology, biochemistry, biology, botany, entomology, physiology, zoology, and other biological sciences.

[2] Includes degrees conferred in statistics.

[3] Includes degrees in astronomy, chemistry, geology, metallurgy, meterology, physics, and other physical sciences.

Source: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979,* pp. 120-22, *1977-78,* pp. 118-119. U.S. Department of Health, Education and Welfare, National Center for Education Statistics, reports on *Earned Degrees Conferred.*

NOTE: Although a strenuous effort has been made to provide a consistent series of data, minor changes have occurred over time in the way degrees are classified and reported. Any degrees classified in early surveys as "first professional" are included above with bachelor's degrees; any degrees classified as "second professional" or "second level" are included with master's degrees. Data for all years are for 50 States and the District of Columbia.

Chart V-18: Percent of bachelor's degrees in science earned by women, 1951-52 to 1975-76

As a percent of total bachelor's degrees, the female share is now at an all-time high for every scientific discipline. The relative position of the fields is stable, however, sociology and psychology have had and continue to have the most degrees; physics and engineering least.

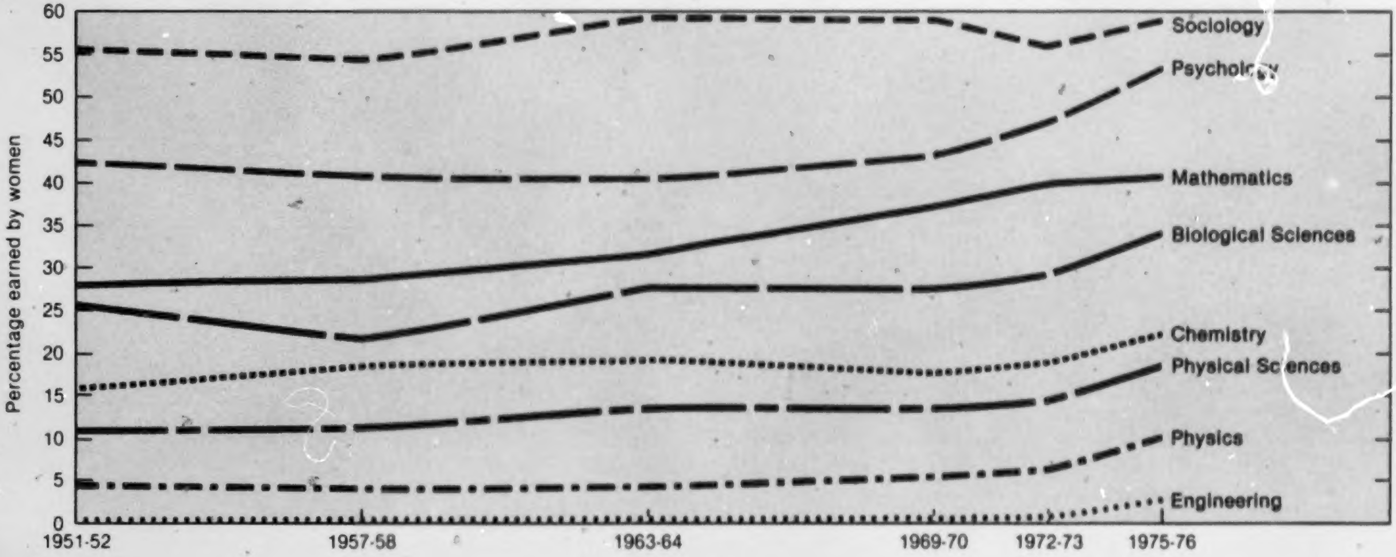


Table V-18: Percent of bachelor's degrees in science earned by women, 1951-52, 1975-76

	1951-52	1957-58	1963-64	1969-70	1972-73	1975-76
Mathematics	28.1%	28.4%	32.[illegible]%	37.4%	40.2%	40.7%
Physics	4.7	4.4	[illegible].7	6.1	7.0	10.9
Physical sciences	10.8	11.6	13.8	13.6	14.8	19.1
Biological sciences	26.0	22.0	28.1	27.8	29.8	34.6
Psychology	42.7	41.1	41.0	43.3	47.6	54.2
Sociology	55.3	54.7	59.4	59.3	56.0	59.3
Engineering	.2	.3	.4	.7	1.2	3.1
Chemistry	16.0	18.6	19.5	17.9	19.0	22.4

Source: National Science Foundation, Office of Program Integration, unpublished data based on: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, pp. 120-22, *1977-78*, pp. 118-19.

Chart V-19: Percent of master's degrees in science earned by women, 1951-52 to 1975-76

With the exception of chemistry, which is slightly below its all-time high, the female share of total master's degrees is at its all-time high for every scientific discipline.

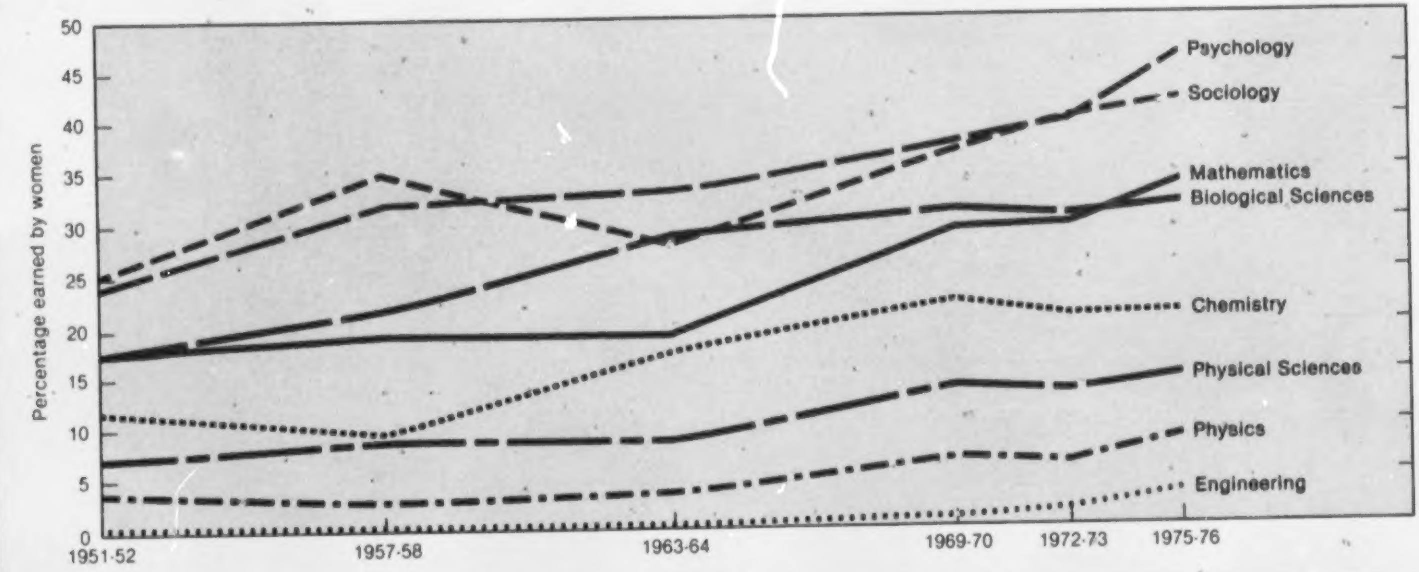


Table V-19: Percent of master's degrees in science earned by women, 1951-52 to 1975-76

	1951-52	1957-58	1963-64	1969-70	1972-73	1975-76
Mathematics	17.3%	19.4%	19.1%	29.6%	29.9%	34.0%
Physics	4.0	3.1	3.6	7.1	6.5	9.1
Physical sciences	7.3	8.9	8.9	14.2	13.5	15.0
Biological sciences	17.3	21.8	28.8	31.5	30.5	31.7
Psychology	24.2	32.3	33.4	38.0	40.1	46.6
Sociology	25.3	35.0	27.9	37.2	40.4	42.0
Engineering	.4	.3	.3	1.1	1.7	3.6
Chemistry	11.9	9.7	17.6	22.4	20.9	21.1

Source: National Science Foundation, Office of Program Integration, unpublished data based on: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, pp. 120-22, *1977-78*, pp. 118-19.

Chart V-20: Percent of doctor's degrees in science earned by women, 1951-52 to 1975-76

As a percent of total doctor's degrees, the female share is now at an all-time high for every scientific discipline.

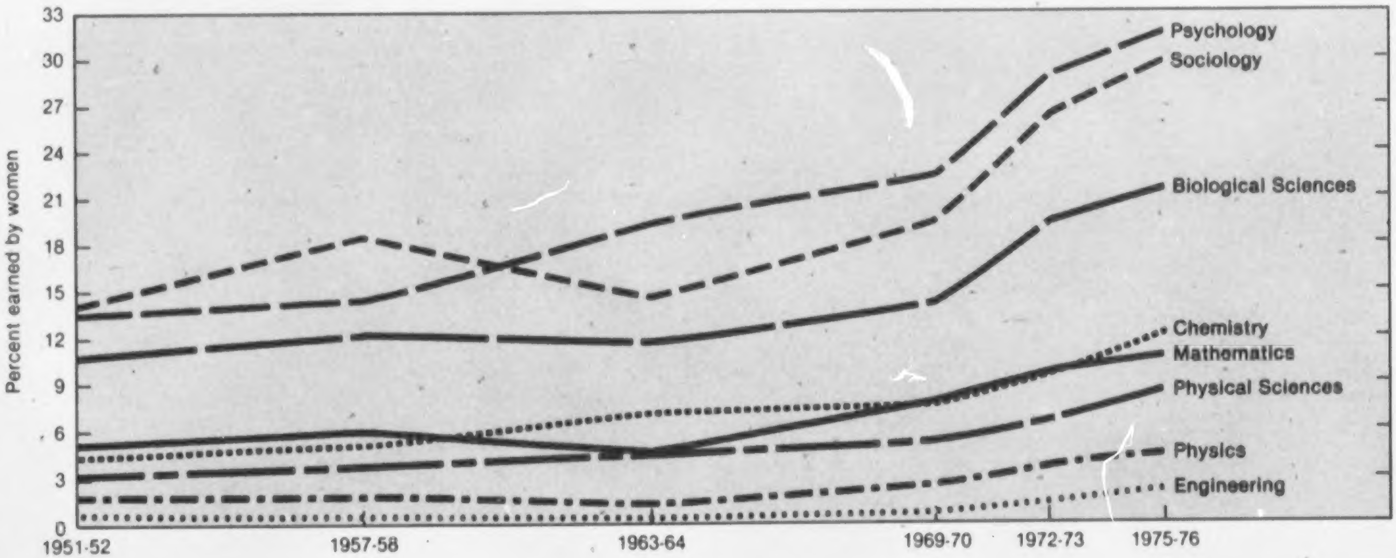


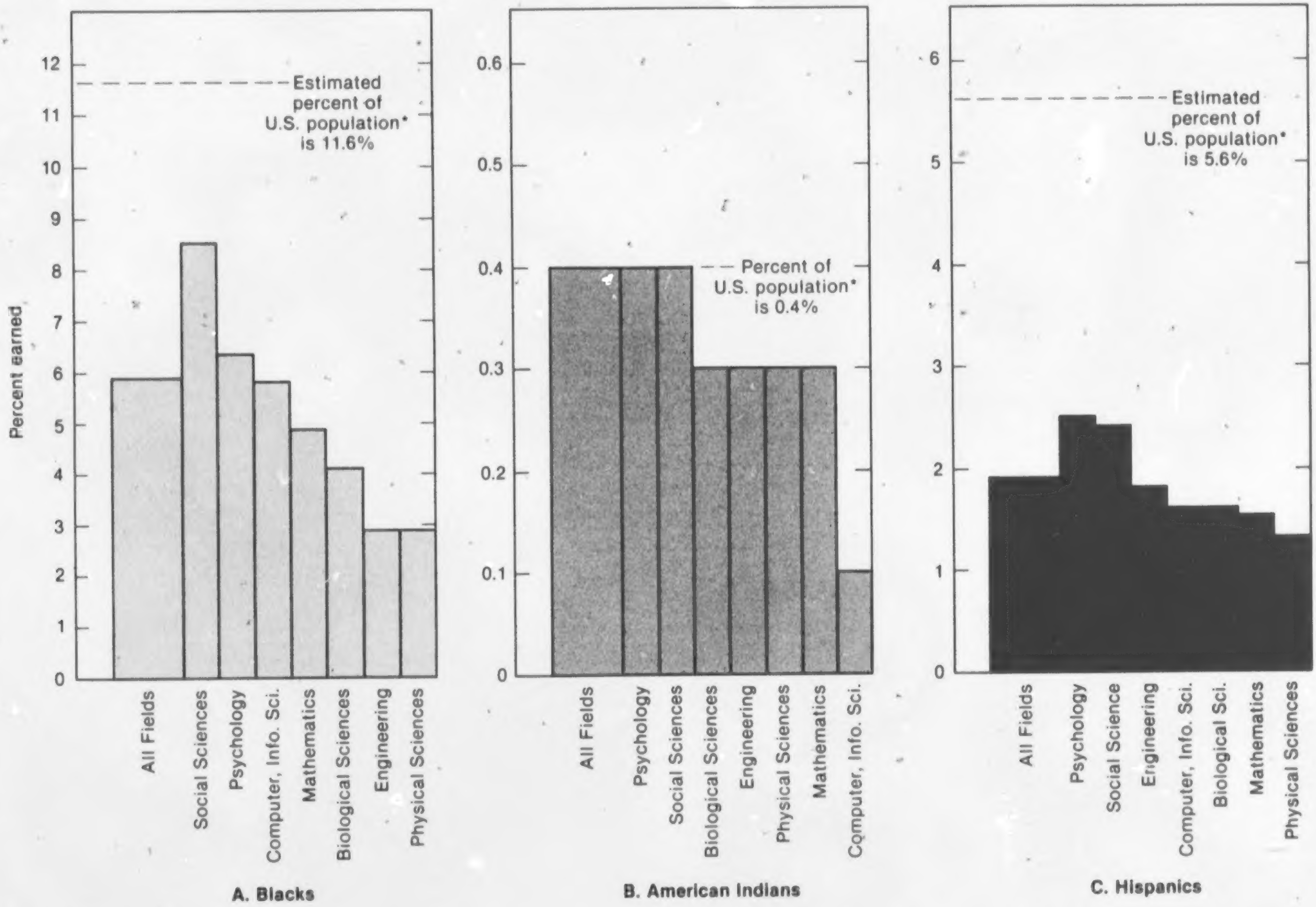
Table V-20: Percent of doctor's degrees in science earned by women, 1951-52 to 1975-76

	1951-52	1957-58	1963-64	1969-70	1972-73	1975-76
Mathematics	5.3%	6.1%	4.7%	7.8%	9.6%	11.0%
Physics	1.9	1.9	1.4	2.6	3.8	4.5
Physical sciences	3.3	4.0	4.7	5.4	6.7	8.7
Biological sciences	11.0	12.3	11.9	14.3	19.5	21.5
Psychology	13.5	14.7	19.4	22.3	29.0	31.7
Sociology	14.2	18.7	14.6	19.5	26.4	29.9
Engineering	.7	.6	.4	.7	1.5	2.3
Chemistry	4.4	5.2	7.2	7.7	9.5	12.1

Source: National Science Foundation, Office of Program Integration, unpublished data based on: Grant, W. Vance and Lind, C. George, *Digest of Education Statistics, 1979*, pp. 120-22, *1977-78*, pp. 118-19.

Charts V-21, A, B & C: Percent of bachelor's degrees in science earned by minorities, by field, 1975-76

Minorities earn more degrees in psychology and social sciences than in physical sciences. American Indians earn degrees in a share more representative of their share of the population than do blacks or Hispanics.



*NOTE: Figures for the Black and Hispanic populations are from the March 1978 Current Population Survey, and therefore are estimates. The population figure for American Indians is from the 1970 census. Also, persons of Hispanic origin may be of any race.

Table V-21: Degrees granted by all higher education institutions, by field and minority status, 1975-76

FIELD		TOTAL			WOMEN			BLACK			AMERICAN INDIAN			ASIAN			HISPANIC			NON RESIDENT ALIEN		
		BS	MS	PHD	BS	MS	PHD	BS	MS	PHD	BS	MS	PHD	BS	MS	PHD	BS	MS	PHD	BS	MS	PHD
All Fields	No.	992,560	310,921	34,035	420,816	144,509	7,797	58,093	19,906	1,164	3,482	774	93	10,994	3,861	541	17,801	5,158	383	14,218	15,558	3,979
	%	100.0	100.0	100.0	45.6	46.5	22.9	5.9	6.4	3.4	0.4	0.2	0.3	1.2	1.2	1.6	1.9	1.7	1.1	1.5	5.0	11.7
Agriculture & Natural Res.		19,402	3,340	928	3,557	478	61	264	74	17	136	5	6	166	50	25	159	27	5	301	555	262
		100.0	100.0	100.0	18.3	14.3	6.6	1.4	2.2	1.8	0.7	0.1	0.6	0.9	1.5	2.7	0.8	0.8	0.5	1.6	16.6	28.2
Architecture & Environmental Design		9,146	3,215	82	1,750	670	13	256	194	5	35	5	—	179	96	1	198	46	—	309	336	17
		100.0	100.0	100.0	19.1	20.8	15.9	2.8	6.0	6.1	0.4	0.2	—	2,0	3.0	1.2	2.2	1.4	—	3.4	10.5	20.7
Area Studies		3,053	943	182	1,714	428	58	106	25	9	10	2	1	65	38	3	127	35	2	31	63	10
		100.0	100.0	100.0	56.1	45.4	31.9	3.5	2.7	4.9	0.3	0.2	0.5	2.1	4.0	1.6	4.2	3.7	1.1	1.0	6.7	5.5
Biological Sciences		54,191	6,582	3,392	18,755	2,085	729	2,228	206	43	140	15	4	1,200	124	84	858	55	22	850	391	346
		100.0	100.0	100.0	34.6	31.7	21.5	4.1	3.1	1.3	0.3	0.2	0.1	2.2	1.9	2.5	1.6	0.8	0.6	1.6	5.9	10.2
Business & Management		143,052	42,244	955	28,206	4,952	52	9,441	1,511	16	424	70	6	1,814	710	16	2,451	476	8	2,907	3,080	154
		100.0	100.0	100.0	19.7	11.7	5.4	6.6	3.6	1.7	0.3	0.2	0.6	1.3	1.7	1.7	1.7	1.1	0.8	2.0	7.3	16.1
Communications		21,282	3,126	204	8,824	1,308	50	1,232	170	8	65	4	2	178	29	—	441	32	5	213	169	11
		100.0	100.0	100.0	41.5	41.8	24.5	5.8	5.4	3.9	0.3	0.1	1.0	0.8	0.9	—	2.1	1.0	2.5	1.0	5.4	5.4
Computer & Information Sci.		5,593	2,545	244	1,118	374	23	322	54	—	7	7	1	122	66	4	87	15	1	211	310	46
		100.0	100.0	100.0	20.0	14.7	9.4	5.8	2.1	—	0.1	0.3	0.4	2.2	2.6	1.6	1.6	0.6	0.4	3.8	12.2	18.9
Education		154,758	127,948	7,769	112,712	82,289	2,593	14,107	12,261	665	740	388	35	766	885	58	2,823	2,388	136	693	2,193	376
		100.0	100.0	100.0	72.8	64.3	33.4	9.1	9.6	8.6	0.5	0.3	0.5	0.5	0.7	0.7	1.8	1.9	1.8	0.4	1.7	4.8
Engineering		45,632	16,011	2,795	1,460	581	66	1,317	208	17	150	38	3	963	487	117	837	219	16	3,106	3,450	973
		100.0	100.0	100.0	3.2	3.6	2.4	2.9	1.3	0.6	0.3	0.2	0.1	2.1	3.0	4.2	1.8	1.4	0.6	6.8	21.5	34.8
Fine & Applied Arts		42,138	8,817	620	25,647	4,310	173	1,687	267	19	153	20	1	598	110	4	654	102	2	515	253	35
		100.0	100.0	100.0	60.9	48.9	27.9	4.0	3.0	3.1	0.4	0.2	0.2	1.4	1.2	0.6	1.6	1.2	0.3	1.2	2.9	5.6
Foreign Languages		15,471	3,531	864	11,807	2,353	414	511	99	7	33	5	3	173	33	6	1,156	208	25	346	171	90
		100.0	100.0	100.0	76.3	66.6	47.9	3.3	2.8	0.8	0.2	0.1	0.3	1.1	0.9	0.7	7.5	5.9	2.9	2.2	4.8	10.4
Health Professions		53,958	12,556	577	42,502	8,339	166	2,643	608	16	164	37	2	836	209	21	895	171	5	551	525	74
		100.0	100.0	100.0	78.8	66.4	28.8	4.9	4.8	2.8	0.3	0.3	0.3	1.5	1.7	3.6	1.7	1.4	0.9	1.0	4.2	12.8
Home Economics		17,409	2,179	178	16,689	1,993	127	1,058	102	5	75	1	—	225	40	3	156	14	1	174	117	13
		100.0	100.0	100.0	95.9	91.5	71.3	6.1	4.7	2.8	0.4	0.1	—	1.3	1.8	1.7	0.9	0.6	0.6	1.0	5.4	7.3
Law*		31,665	1,442	76	6,108	173	3	1,412	18	—	75	2	—	280	12	—	583	11	—	165	257	18
		100.0	100.0	100.0	19.3	12.0	3.9	4.5	1.2	—	0.2	0.1	—	0.9	0.8	—	1.8	0.8	—	0.5	17.8	23.7
Physical Sciences		21,200	5,404	3,429	4,112	817	299	624	127	31	62	9	8	308	138	85	284	53	27	494	628	569
		100.0	100.0	100.0	19.4	15.1	8.7	2.9	2.4	0.9	0.3	0.2	0.2	1.5	2.6	2.5	1.3	1.0	0.8	2.3	11.6	16.6
Letters		51,506	11,293	2,247	29,100	6,581	893	2,382	430	58	161	23	5	355	103	21	716	171	16	454	441	144
		100.0	100.0	100.0	56.5	58.3	39.7	4.6	3.8	2.6	0.3	0.2	0.2	0.7	0.9	0.9	1.4	1.5	0.7	0.9	3.9	6.4
Library Science		843	8,037	71	785	6,296	32	75	423	4	4	17	1	1	95	1	3	94	1	2	188	3
		100.0	100.0	100.0	93.1	78.3	45.1	8.9	5.3	5.6	0.5	0.2	1.4	0.1	1.2	1.4	0.4	1.2	1.4	0.2	2.3	4.2
Math		15,873	3,854	856	6,509	1,310	94	781	119	8	54	8	1	307	93	20	243	51	11	291	292	160
		100.0	100.0	100.0	41.0	34.0	11.0	4.9	3.1	0.9	0.3	0.2	0.1	1.9	2.4	2.3	1.5	1.3	1.3	1.8	7.6	18.7
Military Sciences		178	—	—	2	—	—	4	—	—	—	—	—	—	—	—	1	—	—	13	—	—
		100.0	—	—	1.1	—	—	2.2	—	—	—	—	—	—	—	—	0.6	—	—	7.3	—	—
Psychology		49,828	7,811	2,581	27,076	3,640	819	3,131	409	62	191	14	4	593	88	20	1,243	183	39	450	187	86
		100.0	100.0	100.0	54.3	46.6	31.7	6.3	5.2	2.4	0.4	0.2	0.2	1.2	1.1	0.8	2.5	2.3	1.5	0.9	2.4	3.3
Public Affairs & Services		33,237	17,106	319	14,420	7,698	102	3,286	1,596	28	180	59	2	329	186	5	796	425	13	225	441	26
		100.0	100.0	100.0	43.4	45.0	32.0	9.9	9.3	8.8	0.5	0.3	0.6	1.0	1.1	1.6	2.4	2.5	4.1	0.7	2.6	8.2
Social Sciences		126,390	15,874	4,160	47,915	5,017	900	10,716	858	110	509	37	8	1,345	193	37	2,992	278	40	1,678	1,249	499
		100.0	100.0	100.0	37.9	31.6	21.6	8.5	5.4	2.6	0.4	0.2	0.2	1.1	1.2	0.9	2.4	1.8	1.0	1.3	7.9	12.0
Theology		5,520	3,290	1,033	1,511	1,053	42	148	54	25	10	1	—	32	50	8	48	42	4	129	182	40
		100.0	100.0	100.0	27.4	32.2	4.1	2.7	1.6	2.4	0.2	—	—	0.6	1.5	0.8	0.9	1.3	0.4	2.3	5.5	3.9
Interdisciplinary Studies		32,369	3,773	273	14,545	1,759	88	1,748	95	11	178	7	—	438	26	2	662	62	4	273	80	27
		100.0	100.0	100.0	44.9	46.6	32.2	5.4	2.5	4.0	0.5	0.2	—	1.4	0.7	0.7	1.9	1.6	1.5	0.8	2.1	9.9

*Includes first professional degree.

Sources: U.S. Department of Commerce, Bureau of the Census, *Current Population Reports*, Series P-20, No. 336, and *1970 Census of Population*, Volume I, *U.S. Summary*.
Vetter, Betty M., Babco, Eleanor L., McIntire, Judith E., Professional Women and Minorities: A Manpower Data Resource Service, p. 31 (derived from National Center for Education Statistics, as distributed by the College Placement Council).

Chapter VI

EMPLOYMENT IN SCIENCE AND ENGINEERING

INTRODUCTION

A full understanding of American science education requires that it be related to the context of American society. To what uses do individuals put their science education? Of what use to society is their science education? Most of the data available helps answer the first question and presented here are what seem relevant and useful of that data.

Data in this chapter are presented in two groups: employment and salaries.

HIGHLIGHTS

1. More than half of all doctoral scientists and engineers are employed by educational institutions. (Chart VI-1)
2. Approximately 44% of doctoral scientists and engineers are engaged in R&D as their primary work activity. (Chart VI-2)
3. In general, female scientists and engineers have a higher unemployment rate than males. (Charts VI-3, 4)
4. Male scientists and engineers claim a greater degree of underemployment than females. (Chart VI-5)
5. Male scientists and engineers outearn women scientists and engineers in most fields at all levels. (Charts VI-7 to 11)
6. Beginning salary offers are highest in engineering. (Chart VI-11)

Chart VI-1: Employers of doctoral scientists and engineers, 1973 and 1977

More than half of all doctoral scientists and engineers are employed by educational institutions. No significant trends developed between 1973 and 1977.

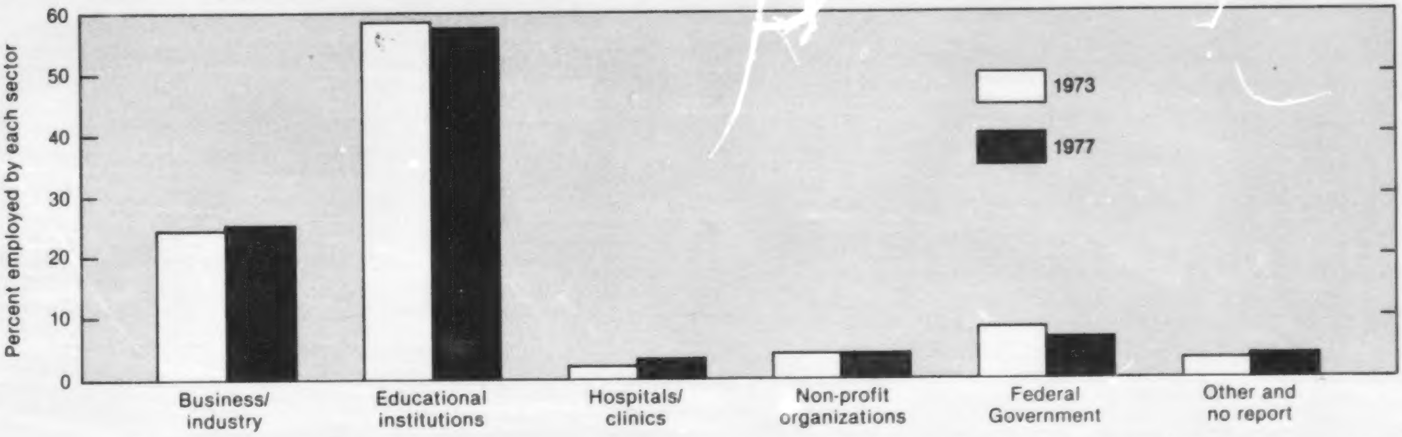


Table VI-1: Employers of doctoral scientists and engineers, 1973 and 1977

Characteristics	1973 Number	1973 Percent	1977 Number	1977 Percent
Total employed	220,400	100.0	284,200	100.0
Type of employment				
Science/engineering[1]	208,300	**94.4**	261,300	**91.9**
Nonscience/engineering	12,100	5.5	22,900	8.1
Sector of employment				
Business/industry	53,400	24.2	71,500	25.2
Educational institutions	129,400	58.7	163,000	57.4
Hospitals/clinics	4,500	2.0	8,600	3.0
Nonprofit organizations	8,000	3.6	10,200	3.6
Federal government[3]	18,200	8.3	21,400	7.5
Other	6,600	3.0	8,200	[2]2.9
No report	300	.1	1,400	.5

[1] Includes postdoctorates.

[2] 1973-77 change in percent is not statistically significant.

[3] Civilian employees only.

NOTES: Details may not add to totals because of rounding. Bold face figures indicate noteworthy changes.

Source: National Science Foundation, Science Resources Studies, *Highlights*, October 4, 1978, p. 3

Chart VI-2: Primary work activity of doctoral scientists and engineers, 1973 and 1977

R&D activities account for approximately 44% of primary work activities among doctoral scientists and engineers. Between 1973 and 1977, there was a 12.4% relative decline in those reporting teaching as their primary work activity.

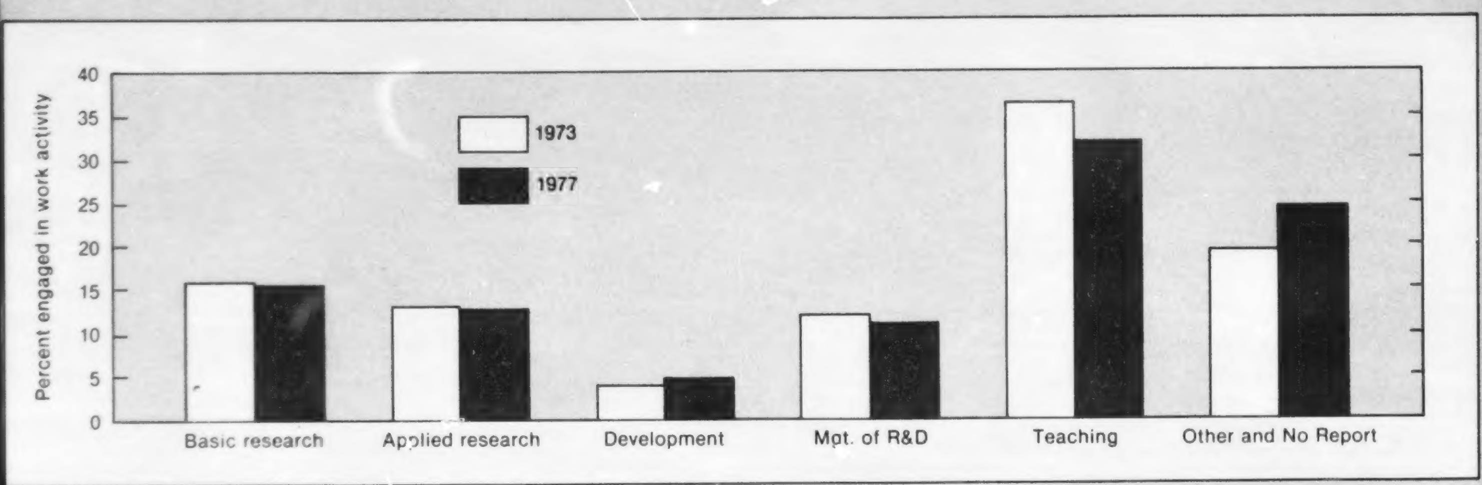


Table VI-2: Primary work activity of doctoral scientists and engineers: 1973 and 1977

Characteristics	1973		1977	
	Number	Percent	Number	Percent
Total employed	220,400	100.0	284,200	100.0
Types of employment				
Science/engineering[1]	208,300	**94.5**	261,300	**91.9**
Nonscience/engineering	12,100	5.5	22,900	8.1
Primary work activity				
Research and development	97,700	44.3	124,200	[2]43.7
Basic research	34,300	15.6	43,500	[2]15.3
Applied research	28,700	13.0	36,400	[2]12.8
Development	8,500	**3.9**	13,500	**4.8**
Mgt. of R&D	26,200	11.9	30,700	10.8
Teaching	80,000	**36.3**	90,400	**31.8**
Other activities	39,000	**17.7**	63,800	**22.4**
No report	3,700	1.7	5,800	2.0

[1] Includes postdoctorates

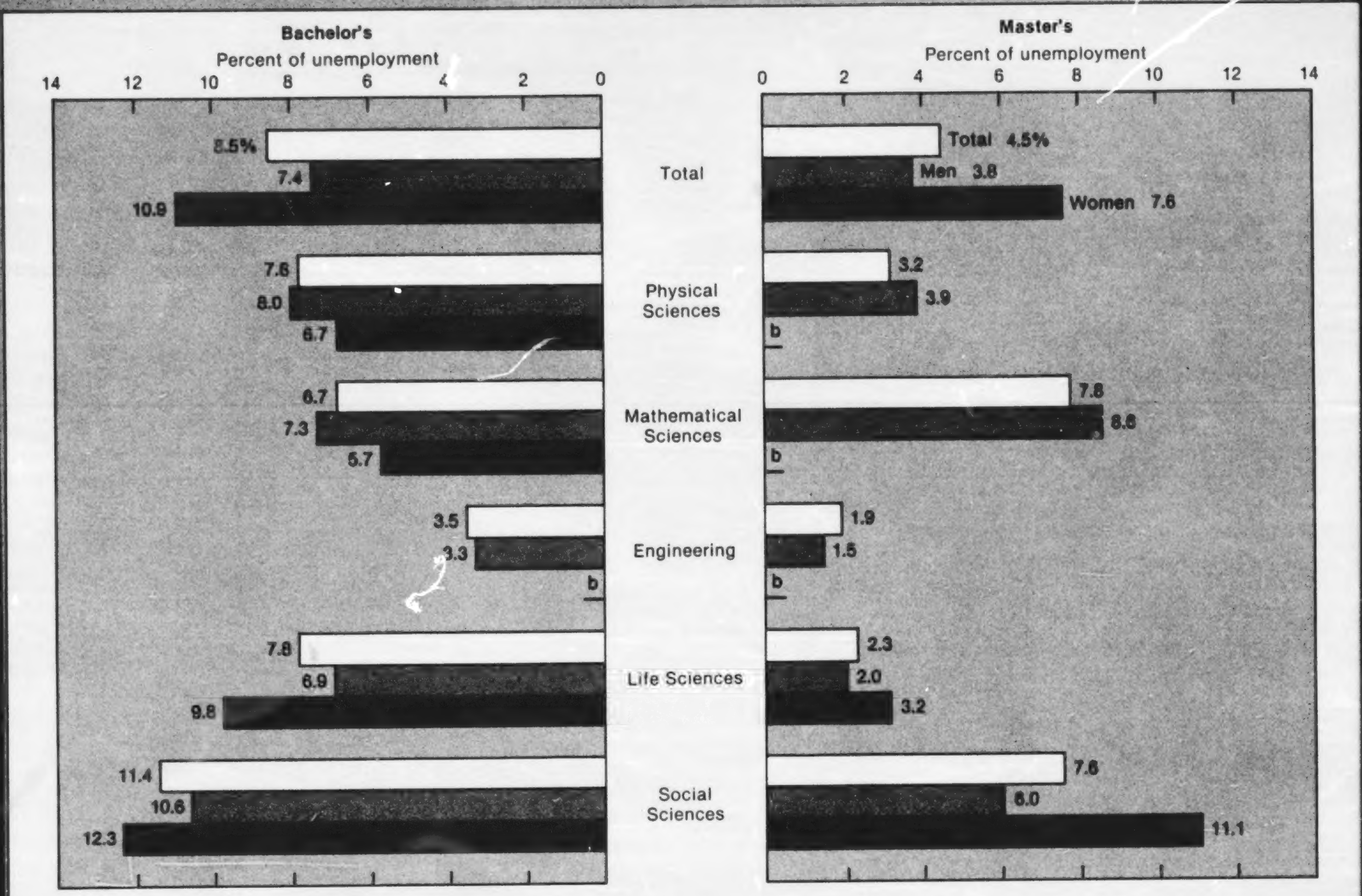
[2] 1973-77 change in percent not statistically significant

NOTES: Details may not add to totals because of rounding. Bold face figures indicate noteworthy change between 1973 and 1977.

Source: National Science Foundation, Science Resources Studies, *Highlights*, October 4, 1978, p. 3.

Chart VI-3: Unemployment rates of 1974 and 1975 science/engineering graduates[a], by field and sex, 1976

Women scientists and engineers show a higher total unemployment rate than men.



[a] Excludes those enrolled full time in graduate school.

[b] No unemployment rate computed for groups with less than 2,500 in labor force.

NOTE: The unemployment rates above reflect the number of individuals who are unemployed and seeking employment expressed as a ratio of the number of the labor force. The number of individuals in the former category is not in the accompanying table.

Source: National Science Foundation, *Reviews of Data on Science Resources*, p. 4.

Table VI-3A: Selected employment characteristics of 1974 and 1975 bachelor's degree recipients[1] in science and engineering by field: 1976

Field of study	Total			Labor force			Total employed			Employed in S/E			Employed in field		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
Total	470,300	318,100	152,200	444,600	306,300	138,300	406,800	283,600	123,200	181,900	145,700	36,200	146,800	118,200	28,600
Physical Sciences	25,200	20,700	4,500	23,800	19,600	4,200	21,900	18,100	3,800	12,900	10,700	2,300	6,800	5,600	1,300
Chemistry	11,100	8,700	2,400	10,400	8,200	2,200	9,500	7,500	2,100	6,400	4,900	1,500	4,400	3,300	1,100
Physics/Astronomy	4,200	3,900	300	4,000	3,700	300	3,600	3,400	200	2,300	2,200	200	800	800	(²)
Environmental Sciences	5,100	4,300	800	4,900	4,100	800	4,600	3,800	700	2,700	2,300	400	1,300	1,200	100
Other Physical Sciences	4,800	3,800	1,000	4,500	3,600	900	4,200	3,400	800	1,500	1,300	200	300	300	100
Mathematical Sciences	42,900	27,600	15,400	41,200	26,700	14,500	38,400	24,800	13,600	21,600	14,700	6,800	16,300	11,100	5,200
Mathematics	33,700	20,600	13,100	32,100	19,800	12,300	29,400	18,000	11,400	13,500	8,700	4,800	9,200	5,800	3,400
Computer Sciences	9,200	7,000	2,300	9,100	6,900	2,200	9,000	6,800	2,200	8,100	6,100	2,000	7,100	5,300	1,800
Engineering	87,800	85,600	2,200	86,100	84,100	2,000	83,200	81,400	1,800	69,400	67,800	1,600	64,600	63,300	1,300
Life Sciences	93,200	64,600	28,600	87,300	61,300	26,000	80,500	57,000	23,400	40,000	28,600	11,300	31,600	21,800	9,800
Biology	65,600	39,800	25,800	60,800	37,400	23,400	55,500	34,300	21,200	26,100	16,200	9,900	19,700	11,200	8,500
Agricultural Sciences	27,600	24,800	2,800	26,500	23,900	2,600	25,000	22,700	2,200	13,800	12,400	1,400	11,900	10,600	1,300
Social Sciences	221,200	119,600	101,500	206,200	114,500	91,800	182,800	102,300	80,400	37,900	23,800	14,200	27,300	16,300	11,000
Psychology	79,000	35,900	43,100	73,400	34,500	38,900	64,100	30,200	33,900	15,600	9,300	6,300	11,000	6,300	4,700
Economics	21,200	17,600	3,600	20,400	17,000	3,500	18,700	15,400	3,300	3,700	3,400	300	2,000	1,900	100
Sociology/Anthropology	67,400	27,200	40,100	62,000	25,500	36,500	54,400	22,600	31,700	10,400	4,900	5,600	8,300	3,700	4,600
Other Social Sciences	53,600	38,900	14,700	50,400	37,500	12,900	45,600	34,100	11,500	8,200	6,200	2,000	6,000	4,400	1,600

[1] Excludes those enrolled full time in graduate school in 1976.

[2] Less than 50.

NOTE: Detail may not add to totals because of rounding.

Source: National Science Foundation, *Reviews of Data on Science Resources*, p. 10.

Table VI-3B: Selected employment characteristics of 1974 and 1975 master's degree recipients[1] in science and engineering by field: 1976

Field of study	Total			Labor force			Total employed			Employed in S/E			Employed in field		
	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women	Total	Men	Women
Total	87,900	70,200	17,700	84,800	68,900	15,900	81,000	66,300	14,700	62,700	53,100	9,700	54,300	45,800	8,600
Physical Sciences	8,400	6,900	1,500	7,800	6,500	1,400	7,700	6,200	1,400	5,200	4,200	1,000	3,500	3,100	600
Chemistry	3,300	2,400	800	3,000	2,300	700	3,000	2,300	700	2,400	1,800	600	2,000	1,600	400
Physics/Astronomy	1,700	1,700	(2)	1,500	1,500	(2)	1,400	1,400	(2)	1,000	1,000	(2)	600	600	(2)
Environmental Sciences	1,400	1,200	300	1,400	1,200	300	1,400	1,100	300	1,200	1,000	200	700	700	100
Other Physical Sciences	2,000	1,600	400	1,900	1,500	400	1,900	1,400	400	600	400	200	200	200	100
Mathematical Sciences	11,200	8,500	2,700	10,600	8,400	2,200	9,800	7,600	2,000	6,700	5,300	1,300	5,300	4,100	1,200
Mathematics	7,000	5,000	2,000	6,400	4,900	1,600	5,700	4,200	1,400	3,200	2,300	800	2,600	1,900	700
Computer Sciences	4,200	3,500	700	4,200	3,500	600	4,100	3,400	600	3,500	3,000	500	2,700	2,200	500
Engineering	28,200	27,300	900	28,000	27,100	900	27,500	26,700	800	25,600	24,900	700	22,500	22,100	400
Life Sciences	14,300	10,600	3,800	13,600	10,000	3,500	13,300	9,800	3,500	10,100	7,600	2,500	9,100	6,600	2,400
Biology	10,300	7,000	3,300	9,800	6,700	3,100	9,600	6,600	3,000	7,[illegible]00	4,900	2,300	6,500	4,300	2,200
Agricultural Sciences	4,000	3,600	500	3,800	3,300	500	3,700	3,200	500	2,900	2,700	200	2,600	2,300	200
Social Sciences	25,800	17,100	8,800	24,700	16,900	7,800	22,800	15,900	7,100	15,200	11,000	4,200	13,900	9,900	4,000
Psychology	10,000	6,100	3,900	9,700	6,100	3,600	9,200	6,000	3,300	7,000	5,000	1,900	6,600	4,800	1,800
Economics	3,500	2,900	600	3,300	2,900	400	3,300	2,900	400	2,200	1,800	400	1,800	1,400	400
Sociology/Anthropology	5,000	2,800	2,200	4,800	2,800	2,000	4,000	2,200	1,900	2,900	1,700	1,200	2,600	1,400	1,200
Other Social Sciences	7,300	5,300	2,100	6,900	5,100	1,900	6,300	4,800	1,500	3,100	2,500	700	2,900	2,300	600

[1] Excludes those enrolled full time in graduate school in 1976.

[2] Less than 50.

NOTE: Detail may not add to total because of rounding.

Source: National Science Foundation, *Reviews of Data on Science Resources*, p. 11.

Chart VI-4: Unemployment rates of doctoral scientists and engineers, by field and sex, 1977

The unemployment rate for women is higher than that for men in every field.

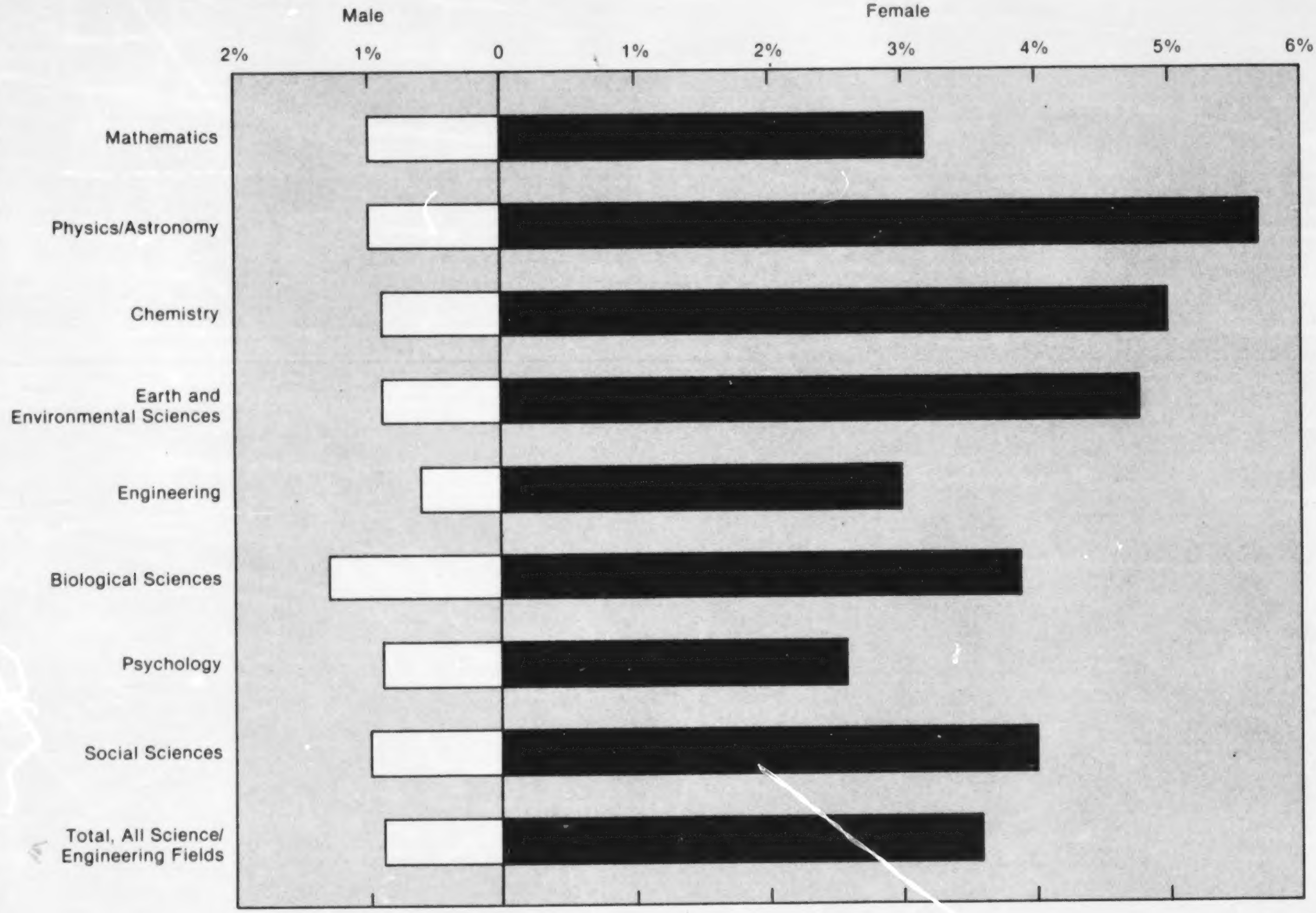


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Table VI-4: Labor force and unemployment rates of doctoral scientists and engineers by field and sex, 1973, 1975 and 1977

	1973				1975				1977			
	MEN		WOMEN		MEN		WOMEN		MEN		WOMEN	
	Labor Force	Unempl. Rate	Labor Force	Unempl. Rate	Labor Force	Unempl. Rate	Labor Force	Unempl. Rate	Labor Force	Unempl. Rate	Labor Force	Unempl. Rate
Total all fields	211,345	0.9	18,046	3.9	241,805	0.8	23,139	3.0	252,940	0.9	27,282	3.6
Math. sciences	14,419	1.2	871	1.7	13,112	0.6	929	2.0	14,119	1.0	1,049	3.2
Computer sciences .	2,826	0.0	88	0.0	3,515	0.0	143	0.0	1,401	0.0	102	0.0
Physics/astronomy .	16,925	1.7	418	7.4	19,108	1.7	511	7.8	24,709	1.0	646	5.7
Chemistry	27,104	1.8	1,344	8.9	34,510	1.0	2,123	3.8	39,116	0.9	2,551	5.0
Earth & environ. sci.	10,074	0.5	268	1.9	12,176	0.7	355	2.3	8,866	0.9	332	4.8
Engineering	34,689	0.8	141	5.0	43,395	0.7	249	1.6	42,841	0.6	231	3.0
Agricultural sci.....	11,055	0.6	149	14.1	13,531	0.3	179	6.1	12,663	0.5	261	2.7
Medical sciences ..	9,743	0.1	1,070	1.8	11,924	0.3	1,573	0.3	6,629	1.0	1,018	1.6
Biological sciences	32,774	0.8	5,167	4.7	34,494	0.9	6,123	4.3	41,791	1.3	7,742	3.9
Psychology	20,008	0.6	4,853	2.8	23,999	0.5	6,561	1.6	25,093	0.9	7,543	2.6
Social sciences	23,742	0.7	2,703	3.2	31,948	0.6	3,360	4.3	35,712	1.0	5,807	4.0

Source: Vetter, Betty M., Babco, Eleanor L., McIntire, Judith E., *Professional Women and Minorities: A Manpower Data Resource Service*, p. 56.

(Derived from: *Characteristics of Doctoral Scientists and Engineers in the United States, 1973,* Detailed Statistical Tables, National Science Foundation, (NSF 75-312A); *Characteristics of Doctoral Scientists and Engineers in the United States, 1975,* (NSF 77-309) and *Science, Engineering & Humanities Doctorates in the United States, 1977 Profile,* National Research Council, 1978.)

Chart VI-5: Average underemployment of 1976-77 bachelor's degree recipients working full-time, by field and sex, February 1978

Except in psychology, men claim a greater degree of underemployment in science and engineering fields.

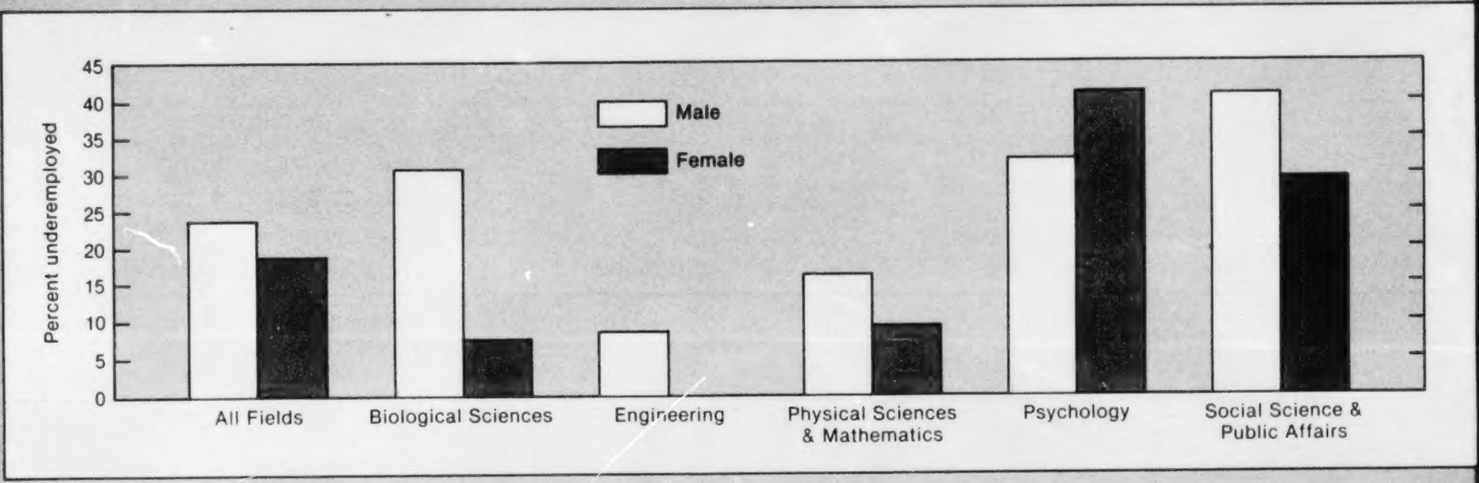

Table VI-5: Average underemployment[1] of 1976-77 bachelor's degree recipients working full-time, by major degree field and sex: February 1978

Major degree field	Percent Underemployed		
	Total	Male	Female
Total	21.6	23.7	19.0
Biological sciences	21.6	30.5	7.8
Engineering	7.9	8.4	0
Physical sciences & mathematics	14.1	16.0	9.4
Psychology	36.8	32.0	41.0
Social sciences & public affairs	36.3	40.4	29.5
Humanities	32.9	32.5	33.2
Business & management	18.6	19.9	14.2
Education	14.0	15.9	13.3
Health professions	2.5	3.4	2.3
Communications	23.0	19.7	26.3
Other	32.7	34.1	31.2

[1] Bachelor's degree recipients working full-time are defined as underemployed if in a job that is not professional, technical, managerial, or administrative and when asked, responded that job did not require a college degree. Definition includes additional stipulation that they are not enrolled in school.

Source: Dearman, Nancy B. and White, Valena Plisko, *The Condition of Education, 1979 Edition*, p. 242.

Chart VI-6: Percent of science and engineering doctorate recipients still seeking* position at time of Ph.D. by sex, 1965-77

It is becoming increasingly more difficult for new doctorate recipients to secure positions.

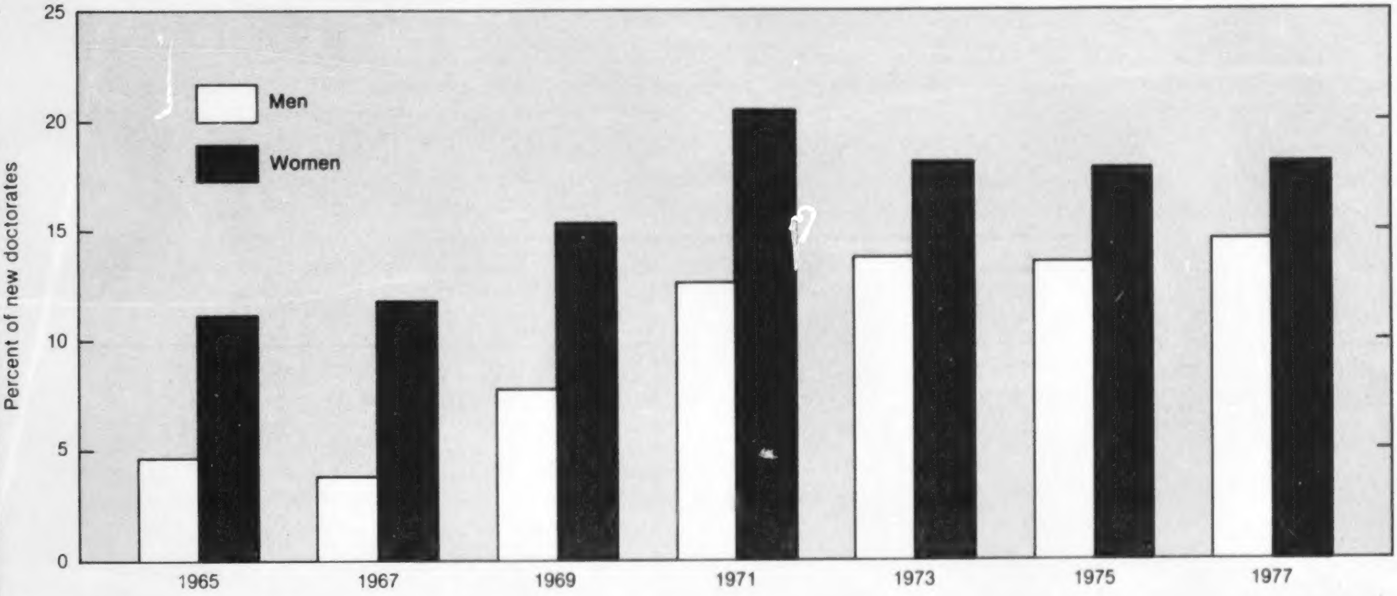

Table VI-6: Percent of science and engineering doctorate recipients still seeking* position at time of Ph.D. by sex, 1965-1977

	Male	Female
1965	4.7	11.1
1967	3.8	11.8
1969	7.8	15.3
1971	12.6	20.4
1973	13.8	18.2
1975	13.6	17.8
1977	14.6	18.2

*Still seeking position is defined as those who checked response 2 to item S on the Survey of Earned Doctorates questionnaire.

Source: NRC, Commission on Human Resources, National Research Council, unpublished data.

Chart VI-7: 1978 Median annual salaries of 1972 bachelor's graduates employed full-time in science and engineering, by field of work and sex

Except in the physical sciences, men outearn women.

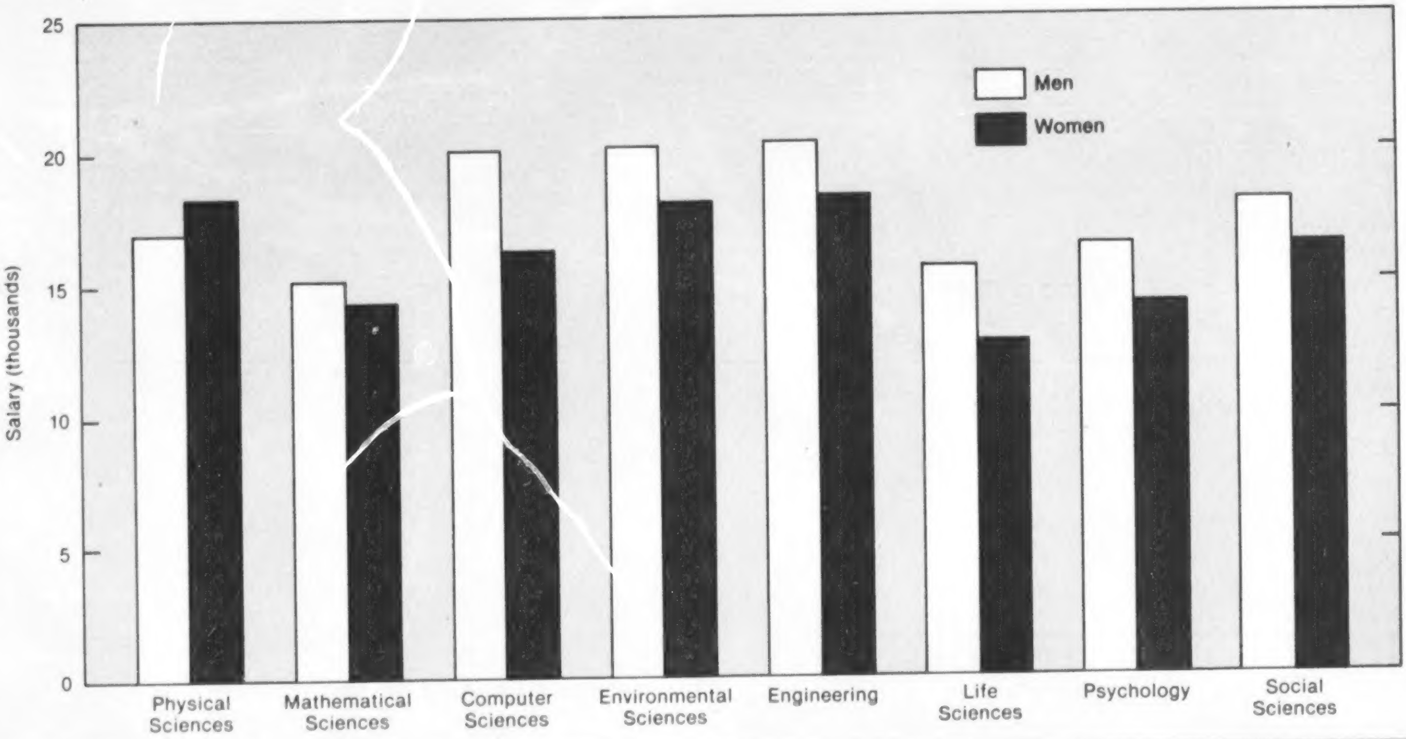

Table VI-7: 1978 median annual salaries of bachelor's graduates of 1972 and 1976 employed full-time in science or engineering, by field of work and sex

Field of work	Bachelor's Graduates of 1972		Bachelor's Graduates of 1976	
	Men	Women	Men	Women
All Fields	19,644	15,225	15,598	12,092
Physical sciences	16,917	18,200•	14,077	13,111
Chemistry	16,341	18,200•	14,206	13,079
Physics/Astronomy	18,520	—	12,088	16,632•
Other physical sciences	21,846	18,200	13,899	12,931
Mathematical sciences	15,141	14,297	14,794	13,000
Computer specialities	20,001	16,208	16,383	16,013
Environmental sciences	20,116	18,043	13,725	13,571
Earth	20,283	18,108	14,930	18,008•
Other	18,853	16,350	12,008	13,400•
Engineering	20,348	18,206	17,210	16,171
Chemical	22,125	24,150•	19,017	19,289•
Civil	19,513	19,600•	16,459	17,400•
Electrical	22,089	18,400	18,088	14,697
Mechanical	20,897	15,800	18,052	14,965
Life sciences	15,453	12,666	11,217	10,265
Biology	15,088	12,603	10,291	10,294•
Agriculture	16,689	18,164•	12,140	10,157
Psychology	16,319	14,108	10,144	10,972•
Social sciences	18,007	16,262	12,922	11,044
Economics	18,116	16,359	15,050	16,950•
Sociology/anthropology	18,948	9,933	13,171	8,900
Other social sciences	16,582	16,935•	12,526	11,040

—Data not available

•Women's salaries higher than men's

Source: Vetter, Betty M., *Labor Force Participation of Women Trained in Science and Engineering and Factors Affecting Their Participation*, p. 47.

Chart VI-8: Average annual salaries of 1976-77 bachelor's-degree recipients working full-time, by field and sex, February 1978

Men outearn women in all fields except engineering, which is also the field providing the greatest salary.

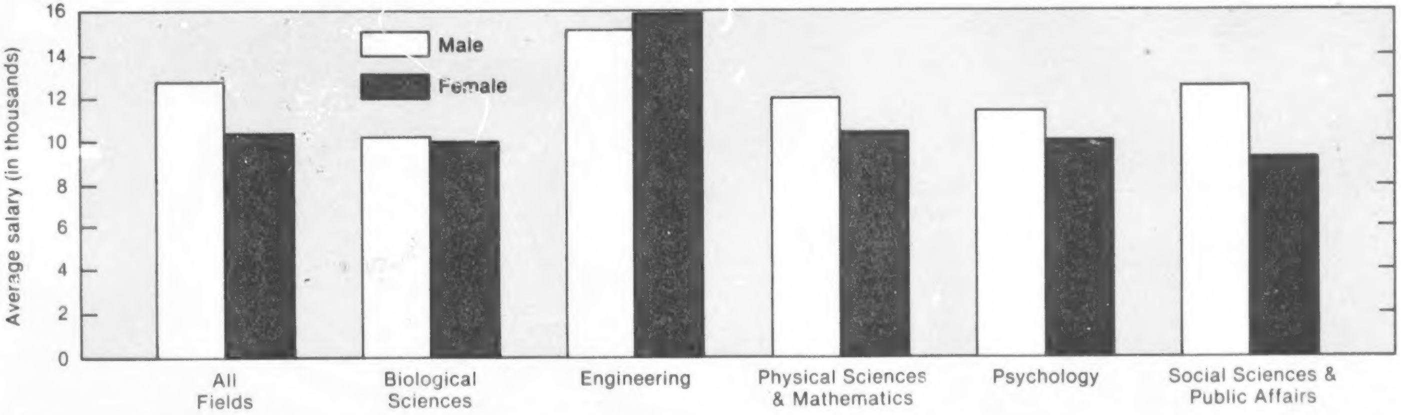

Table VI-8: Average annual[1] salaries of 1976-77 bachelor's degree recipients working full-time, by major degree field and sex: February 1978

Major degree field	Average salary Total	Male	Female
Total	$11,700	$12,700	$10,300
Biological sciences	10,100	10,200	10,000
Engineering	15,200	15,200	15,900
Physical sciences & mathematics	11,600	12,000	10,400
Psychology	10,700	11,400	10,000
Social sciences & public affairs	11,300	12,507	9,200
Humanities	9,500	10,300	8,800
Business & management	13,200	13,700	11,300
Education	11,100	11,700	10,800
Health professions	12,300	14,100	11,900
Communications	10,200	11,300	9,100
Other	10,500	11,900	8,800

[1] Salaries of teachers working on 9 to 10 month contracts have been adjusted to 12 month salaries.

Source: Dearman, Nancy and White, Valena Plisko, *The Condition of Education, 1979 Edition*, p. 242.

Chart VI-9: Beginning offers to bachelor's degree candidates: 1978-79

Consistent with Chart VI-8, the greatest starting salaries are in engineering and this is the only S/E field where women command a larger salary than men.

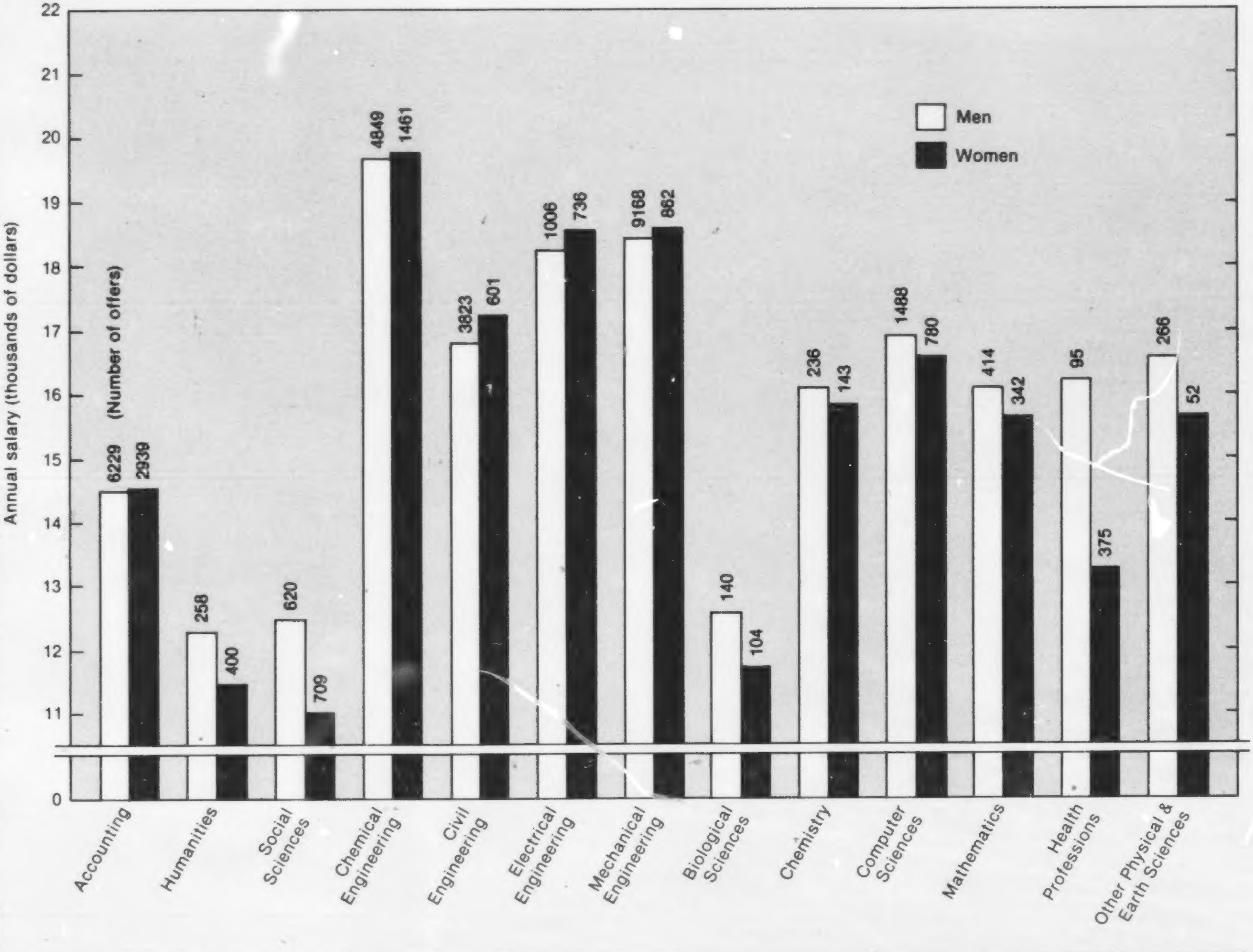

Table VI-9: Beginning offers to bachelor's-degree candidates: 1978-79

By Curriculum for All Types of Employers	Men		Women	
	No. Offers 1978-79, Final Report, July 1979 Total	Avg. $ Offer 1978-79 Total	No. Offers 1978-79, Final Report, July 1979 Total	Avg. $ Offer 1978-79 Total
Business				
Accounting	6,269	$14,460	2,939	$14,484
Business-General (inc. Mgmt.)	3,345	13,332	1,451	12,984
Marketing & Distribution	1,368	12,732	857	12,072
Humanities and Social Sciences				
Humanities	258	12,275	400	11,484
Economics[1]	394	18,072	224	13,200
Other Social Sciences	620	12,464	709	10,968
Engineering				
Engineering-Aeronautical	564	18,072	44	17,988
Engineering-Chemical	4,849	19,680	1,461	19,775
Engineering-Civil	3,823	16,764	601	17,220
Engineering-Electrical (including Computer Engineering)	10,006	18,216	736	18,552
Engineering-Industrial	1,404	17,832	419	18,072
Engineering-Mechanical	9,168	18,420	862	18,600
Engineering-Metallurgical (incl. Metallurgy & Engrg.-Ceramics)	687	18,780	127	19,175
Engineering-Mining	174	19,235	18	19,932
Engineering-Nuclear (incl. Engrg. Physics)	322	17,832	34	17,736
Engineering-Petroleum	687	21,528	30	21,324
Engineering Technology	1,872	17,195	78	17,088
Sciences				
Agricultural Sciences	464	12,768	93	11,484
Biological Sciences	140	12,576	104	11,700
Chemistry	236	16,080	143	15,828
Computer Science	1,488	16,932	780	16,572
Health (Medical) Professions	95	16,204	375	13,248
Mathematics	414	16,080	342	15,648
Other Physical & Earth Sciences	266	16,560	52	15,648
	48,913		12,879	

[1] Includes Economics programs with both Business and Social Science orientation.

Source: College Placement Council, Inc., *CPC Salary Survey*, p. 4.

Chart VI-10: 1978 Median annual salaries of 1972 master's graduates employed full-time in science and engineering, by field of work and sex

At the master's level, women earn more than men in mathematics.

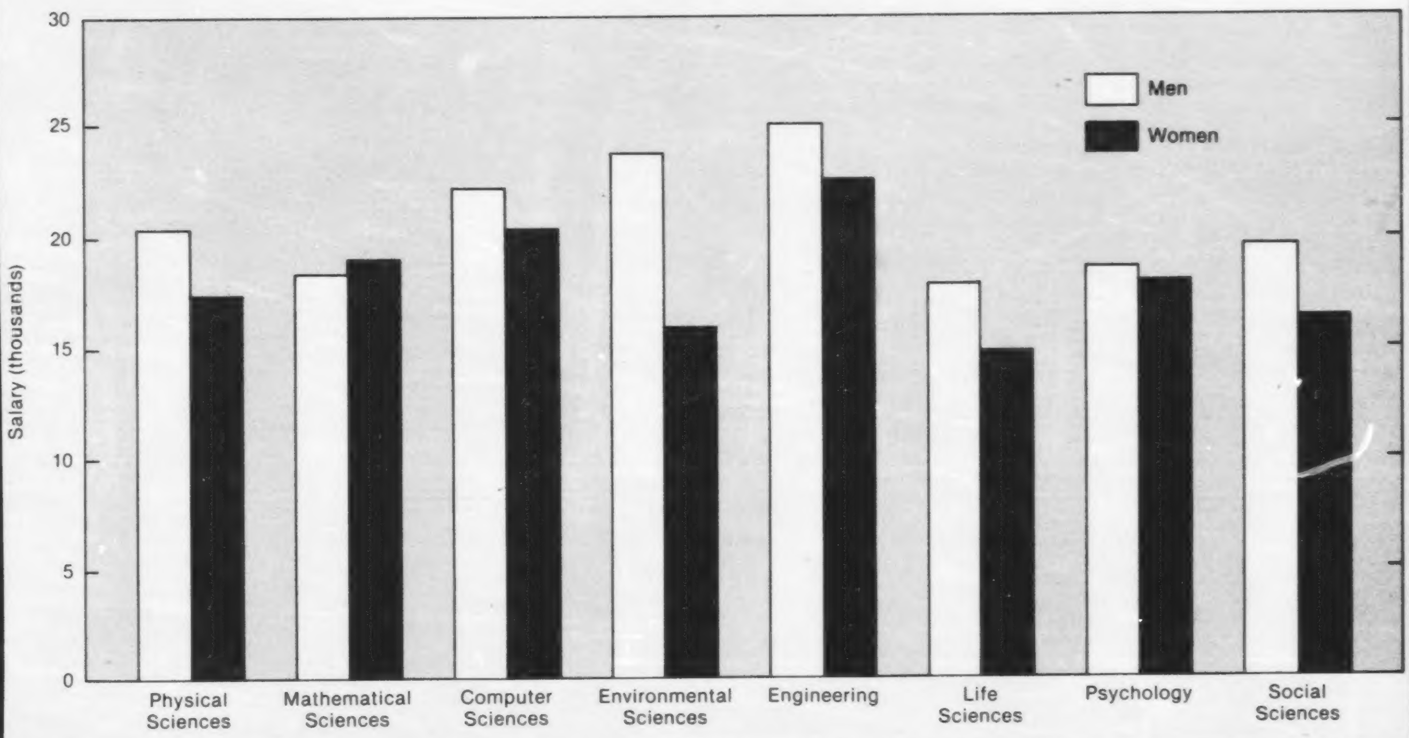

Table VI-10: 1978 Median annual salaries of master's graduates of 1972 & 1976 employed full-time in science or engineering, by field of work & sex

Field of Work	Master's graduates of 1972		Master's graduates of 1976	
	Men	Women	Men	Women
All fields	22,865	18,115	19,074	15,010
Physical sciences	20,315	17,324	18,343	13,776
Chemistry	20,721	17,507	18,460	13,741
Physics/astronomy	20,185	16,600	18,721	16,200
Other physical sciences	20,305	—	15,339	13,000
Mathematical sciences	18,301	19,000•	14,967	16,151•
Computer specialities	22,290	20,410	20,013	17,805
Environmental sciences	23,788	15,865	20,392	15,060
Earth	25,663	15,903	21,783	15,110
Other	17,819	14,746	12,071	15,000•
Engineering	25,044	22,468	21,094	19,902
Chemical	24,288	27,200•	22,203	19,800
Civil	24,361	29,867•	20,314	17,000
Electrical	25,188	19,117	20,947	18,200
Mechanical	24,671	22,083	21,850	24,462•
Life sciences	17,873	14,922	14,642	13,180
Biology	16,967	14,869	14,479	13,355
Agriculture	20,086	15,000	14,851	12,700
Psychology	18,625	18,038	13,499	14,402•
Social sciences	19,494	16,342	16,174	14,803
Economics	21,700	29,761•	16,320	15,100
Sociology/anthropology	18,170	14,979	13,752	10,101
Other social sciences	17,179	22,363•	16,764	14,880

—Data not available

•Women's salaries higher than men's

Source: Vetter, Betty M., *Labor Force Participation of Women Trained in Science and Engineering and Factors Affecting Their Participation*, p. 47.

Chart VI-11: Median annual salaries of doctoral scientists and engineers, by field and sex: 1973 and 1977

At the doctorate level, men outearn women in every discipline.

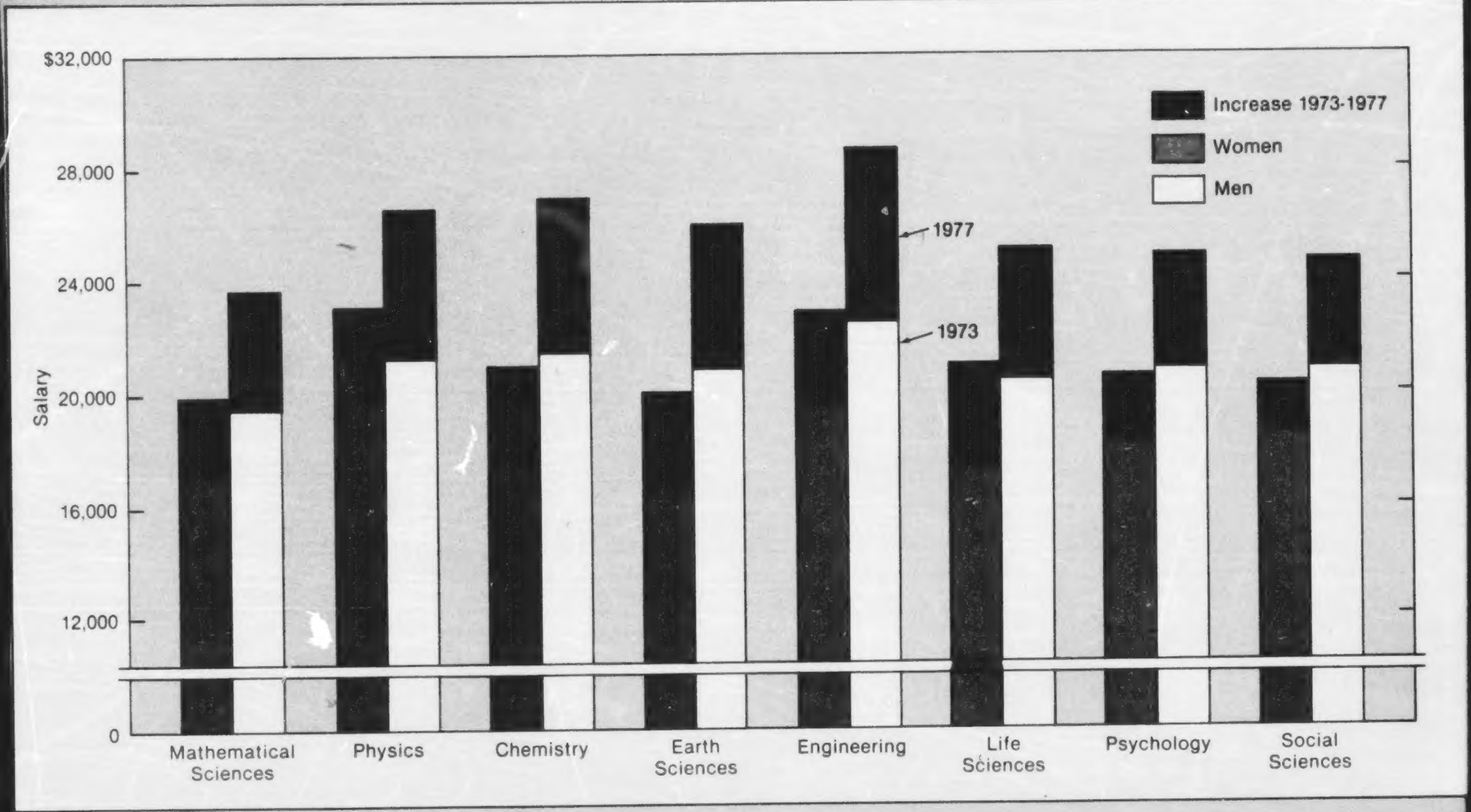

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Table VI-11: Median annual salaries of doctoral scientists and engineers, by field and sex: 1973 and 1977

	1973			1977		
		Sex			Sex	
Field	Total	Men	Women	Total	Men	Women
All fields	$20,900	$21,200	$17,600	$25,600	$26,000	$20,700
Physical scientists	21,200	21,400	17,400	26,600	26,800	21,200
Chemists	21,300	21,400	17,300	26,600	27,000	20,900
Physicists & astronomers	21,100	21,200	17,700	26,500	26,600	23,100
Mathematical scientists	19,300	19,400	17,100	23,300	23,600	19,900
Mathematicians	19,100	19,300	16,800	23,100	23,400	19,900
Statisticians	20,800	20,800	19,500	25,100	25,400	19,800
Computer specialists	22,100	22,300	17,700	25,800	26,100	20,800
Environmental scientists	20,700	20,900	17,000	25,800	26,000	19,700
Earth scientists	20,700	20,800	16,700	25,900	26,000	20,000
Oceanographers	19,400	19,500	—	24,100	24,400	19,200
Atmospheric scientists	22,800	22,800	—	28,300	28,900	19,200
Engineers	22,500	22,500	19,600	28,600	28,700	22,900
Life scientists	20,000	20,400	17,300	24,700	25,100	21,000
Biological scientists	19,500	19,900	17,100	23,800	24,300	20,500
Agricultural scientists	19,800	19,800	—	24,800	24,900	20,200
Medical scientists	23,000	23,500	18,300	28,000	28,900	22,800
Psychologists	20,200	20,800	18,200	24,100	24,900	20,600
Social scientists	20,400	20,800	17,600	24,100	24,700	20,200
Economists	22,300	22,500	19,300	27,000	27,500	23,600
Sociologists/anthropologists	19,500	20,200	17,100	22,200	22,900	19,700
Other social scientists	19,600	19,900	17,400	23,200	23,900	19,800

NOTE: All median salaries were computed only for full-time employed civilians. No median was computed for groups with fewer than 20 individuals reporting salary.

Source: National Science Foundation. *Characteristics of Doctoral Scientists and Engineers in the United States: 1977. Technical Notes and Detailed Statistical Tables*, p. 50. Also Characteristics of Doctoral Scientists and Engineers in the United States, 1973. Detailed Statistical Tables, Appendix B., p. 141.

BIBLIOGRAPHY

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ANNOTATED BIBLIOGRAPHY

Admissions Testing Program of the College Board. *National report, College-bound seniors, 1972-73, 1973-74, 1974-75, 1975-76, 1977, 1978, 1979.* Princeton: Educational Testing Service, 1973-79.

National Report, College-Bound Seniors for the years 1973 through 1979 summarizes the College Board ATP records of high school seniors who registered for Scholastic Aptitude Tests (SAT) or Achievement Tests at any time during their high school years. The 1979 report presents data for about one million seniors, about a third of all seniors of 1979 and about two-thirds of all who go directly to college. Included are summaries of scores for the SAT, and the Achievement Tests, and from the Student Descriptive Questionnaire (SDQ) data on high school records of students, their socioeconomic characteristics, and their college plans. Results of the Test of Standard Written English (TSWE) are included from 1974-75 onwards. Copyright © 1977, 1978, 1979 by College Entrance Examination Board, New York.

Atelsek, Frank J. and Gomberg, Irene L. *Young doctoral faculty in science and engineering: Trends in composition and research activity.* (Higher Education Panel Report, Number 43) Washington, D.C.: American Council on Education, February 1979.

Young Doctoral Faculty in Science and Engineering: Trends in Composition and Research Activity is the report of a survey funded by the National Science Foundation, the U.S. Office of Education, and the National Institute of Education to ascertain the extent of declines in the proportion of young doctorates in science and engineering faculties. The report discusses expected faculty hiring during 1978-79, comparisons with earlier surveys, trends in faculty composition, and measures of research activities of younger and older faculty members.

Carnegie Foundation for the Advancement of Teaching. *Missions of the college curriculum.* San Francisco: Jossey-Bass, 1977.

Missions of the College Curriculum seeks to describe for persons involved with curriculum, particularly those new to the responsibilities therein, the current state of American curricula in institutions of higher education and ways of change and development. The preface observes that the timing of the study is such because higher education has undergone considerable change in the past decade, that change is continuing, and that the period ahead is one of no growth for higher education but important social changes for society. Fourteen chapters and four appendices comprise the volume.

Association of Science-Technology Centers. *ASTC science museum funding study.* Unpublished report, Washington, D.C., January 19, 1979.

ASTC Science Museum Funding Study represents a preliminary, unverified by agencies, draft-form report of the structure of lead agency support for science museums from federal sources. The data were gathered from agency annual reports, program office reports, and individual museum reports of federal funding. Since it provides preliminary estimates, it can only give rough estimates until more precise data are made available.

College Placement Council Inc. *CPC salary survey: A study of 1978-79 beginning offers, final report*, July 1979. Bethlehem, PA: 1979.

The **CPC Salary Survey** presents data on beginning monthly salary offers made to graduates at all degree levels from a representative group of colleges and universities in the United States. A broad number of job types is surveyed, although teaching is excluded. The College Placement Council issues reports five times annually to members and subscribers. This report contains 2 pages of text analysis and 9 pages of tables and charts covering offers by sex, field, type of employer, and level of degree.

Dearman, Nancy B. and White, Valena Plisko, *The condition of education, 1979 edition,* (National Center for Education Statistics, Statistical Report, Stock No. 017-080-02008-4) Washington, D.C.: U.S. Government Printing Office, 1979.

The Condition of Education, 1979 Edition, is the fifth annual report in a series describing various conditions in education as well as in the larger society affecting education. The first of its two parts provides an overview of education in three sections: the social context of education (the family, work and the community); elementary and secondary education (enrollments, school environment, *etc.*); postsecondary education (enrollments in higher and adult education, faculties, finances, *etc.*). The second part of the volume deals with three selected topics: financing precollege public education; outcomes of education; and the status of women and minorities in higher education. There is an appendix, and a cumulative index. The format of the text is a discussion of the section followed by numerous tables each accompanied by an illustrative chart.

Engineering Manpower Commission of Engineers Joint Council. *Engineering manpower bulletin*, No. 47. New York: Engineers Joint Council, May 1979.

Engineering Manpower Bulletins provide information on trends and developments in manpower for engineering and related technologies. Number 47 summarizes a two-part report, *Engineering and Technology Enrollments Fall 1978*, presenting four tables, one figure and interpretive text on current and past engineering enrollments.

Frankel, Martin M. *Projections of education statistics to 1986-87*, (National Center for Education Statistics, Stock No. 017-080-01918-3). Washington, D.C.: U.S. Government Printing Office, 1978.

Projections of Education Statistics to 1986-87 provides projections of statistics for elementary schools, secondary schools, and institutions of higher education. The projections which are revised annually based upon newly collected data by NCES include statistics on enrollments, graduates, teachers, and expenditures. The latest population projects and estimates from the Bureau of the Census are also incorporated in the volume on a yearly basis.

Golladay, Mary A. and Noell, Jay. *The condition of education, 1978 edition*, (National Center for Education Statistics, Statistical Report, Stock No. 017-080-01822-5). Washington, D.C.: U.S. Government Printing Office, 1978.

The Condition of Education, 1978 Edition is an annual statistical report describing various conditions in education as well as in the larger society affecting education. This volume, which is the fourth report to be published in this series, is organized into two parts. The first part is concerned with trends and developments at all levels of education including the societal context for describing education (e.g., public opinion, school age population, financial support); elementary and secondary education (e.g., public and professional opinion, enrollments, outcomes); and post secondary education (e.g., enrollment in higher education, characteristics of institutions, and adult education). The second part looks at educational personnel, the financing of higher education, and a comparison of education and labor force participation patterns in the United States and other selected nations. The format of the volume is a discussion of a topic followed by numerous tables and charts in which each table is illustrated on the following page by a chart (i.e., a statistical graph).

Gooler, Dennis D. The development and use of educational indicators. *Educational indicators: Monitoring the state of education.* (Proceedings of the 1975 ETS Invitational Conference) Princeton: Educational Testing Service, 1976.

The Development and Use of Educational Indicators suggested the main features of the organizing framework for this Databook. Gooler categorizes educational indicators as follows: access, aspirations, achievement, impact, and resources. He notes that the information base for access and resources is reasonably good, adequate for achievement, and poor for aspirations and impact.

Grant, W. Vance and Lind, C. George. *Digest of education statistics 1977-78* and *1979*, (National Center for Educatio Statistics). Washington, D.C.: U.S. Government Printing Office, 1978, 1979.

Digest of Education Statistics, 1977-78, and 1979 continue a series published annually since 1962. They provide an abstrac of statistical information covering American education from kindergarten through graduate school. The Digest includes data on the number of schools and colleges, enrollments, teachers, graduates, attainments, finances, federal funds fo education, libraries, international education, and research and development. The 1977-78 edition, also contains a number o innovations from previous editions, such as NAEP data o social and political attitudes of 13- and 17-year-olds, years fo computing school attendance in each state, trends o Scholastic Aptitude Test scores, college dropouts for the hig school class of 1972, expenditures for school lunch programs, and expenditures for public libraries. The 1979 edition's innovations include data on trends in engineering enrollments and on earned degrees conferred in mathematics, biologica sciences and physical sciences.

Hamblen, John W. and Baird, Thomas B., (Eds.). *Fourth inventory of computers in higher education.* Princeton: Edcom, 1979.

Fourth Inventory of Computers in Higher Education reports data from the fourth national survey of computers in highe education. The book consists primarily of tables on computers: numbers of, expenditures, degree programs, instructional and administrative use, student access, and othe topics. An interpretive report is due to be published in early 1980.

Klus, John P. and Jones, Judy A. *Survey of continuing education activities for engineers and scientists.* Washington, D.C.: The American Society for Engineering Education, 1978.

Survey of Continuing Education Activities for Engineers and Scientists summarizes the findings of a poll of 349 universities and professional/technical associations concerning their activities in continuing education. Included in the summary are statistics related to noncredit activities, such as, intensive short courses; non-credit after-hours courses; institutes, seminars, etc.; correspondence courses; and self study activities. Also discussed are degree credit courses and the development and operation of courses with attention to such factors as needs analyses, promotion, evaluations, and funding.

Malitz, Gerald S. *Associate degrees and other formal awards below the baccalaureate: Analysis of 6-year trends* (National Center for Education Statistics, Stock No. 017-080-01848-9). Washington, D.C.: U.S. Government Printing Office, 1978.

Associate Degrees and Other Formal Awards Below the Baccalaureate: Analysis of 6-Year Trends is based upon a survey which is part of the Higher Education General Information Survey (HEGIS) conducted annually by NCES. This report which focuses upon the years 1970-71 through 1975-76 compares data available on curriculum categories and divisions, types of instructional units, and classifications of degrees and awards. Included are associate degrees and all other formal awards which require at least two but less than four years of post secondary work, regardless of whether or not the work was intended to be applicable toward a baccalaureate degree.

National Assessment of Educational Progress. *Changes in social studies performance, 1972-76.* (National Center for Education Statistics, Report No. 07-SS-01). Denver, Colorado: 1978.

Changes in Social Studies Performance, 1972-76 studies the changes in two surveys conducted by NAEP to measure achievement in social studies during the 1971-72 school year and during the 1975-76 school year. These surveys provided data on changes in social studies achievement for young Americans aged 9, 13, and 17. Changes were reported in knowledge, skills, and attitudes, related to economics, geography, history, and politics. The publication includes sample items from the surveys as well as the statistics (charts, graphs, etc.) related to the changes.

National Assessment of Educational Progress. *Attitudes toward science: A summary of results from the 1976-77 national assessment of science.* (National Institute of Education, Report No. 08-S-02) Denver, Colorado: 1979.

Attitudes toward Science presents findings from the 1976-77 assessment of science that indicate how students ages 9, 13, and 17, and in some cases young adults (ages 26-35), responded to questions on three major topics: 1) personal experience with science, 2) science and society, and 3) awareness of the philosophy and methodology of science. The data are analyzed by age, racial, geographic, and other categories.

National Assessment of Educational Progress. *Changes in mathematical achievement, 1973-78.* (National Institute of Education, Report No. 09-MA-01) Denver, Colorado: 1979.

Changes in Mathematical Achievement, 1973-78, relates the changes in two surveys conducted by NAEP to measure achievement in mathematics during the school years of 1972-73 and 1977-78. The subjects of the surveys were 9-, 13-and 17-year-olds. The 1977-78 assessment dealt with four cognitive process levels (knowledge, skills, understanding, and application) across a variety of traditional mathematics content areas (numbers and numeration, variables and relationships, geometry, measurement, and other topics such as graphs, and probability). The publication includes sample items from the surveys as well as the statistics (tables, charts, etc.) related to the changes.

National Assessment of Educational Progress. *Energy knowledge and attitudes: A national assessment of energy awareness among young adults.* (National Center for Education Statistics, Report No. 08-E-01) Denver, Colorado: 1978.

Energy Knowledge and Attitudes: A National Assessment of Energy Awareness Among Young Adults is a report of a survey administered to a sample of American adults during the summer of 1977. Seventy knowledge questions and 76 attitudinal questions were given in this assessment. The questions measuring knowledge fell into three major categories: (1) basic energy facts, (2) general energy issues, and (3) energy conservation. The attitude questions were categorized into four major classifications: (1) feelings about the seriousness of energy problems, (2) belief in the effectiveness of personal action, (3) feelings toward environmental hazards, and (4) feelings toward energy trade-offs.

National Assessment of Educational Progress. *Mathematical knowledge and skills.* (National Institute of Education, Report No. 09-MA-02) Denver, Colorado: 1979.

Mathematical Knowledge and Skills presents the achievement of 9-, 13-, and 17-year-olds during the school year 1977-78 as shown in the NAEP survey. Results and sample items, are presented for knowledge in numbers and numeration, geometry, and measurement; for computational skills with whole numbers, fractions, decimals, integers, percents and fractional conversions; for skills in measurement, reading graphs and tables, geometric and algebraic manipulations, and estimating. Some groups and age-level comparisons are made and as observations and recommendations.

National Assessment of Educational Progress. *Three national assessments of science: Changes in achievement, 1969-77.* (National Center for Education Statistics, Report No. 08-S-00). Denver, Colorado: 1978.

Three National Assessments of Science: Changes in Achievement, 1969-77 is a study of the changes in the three national science assessments: 1969-70, 1972-73, and 1976-77. In each assessment, students were assessed for achievement in three broad objectives of science education: (1) fundamental aspects of science; (2) applications of fundamentals to a wide range of problem situations; and (3) appreciation of the processes of science, its consequences and limitations, and the personal and social relevance of science to society. The second and third assessments contained questions from the first assessment so that comparisons could be made.

National Science Foundation. *Characteristics of doctoral scientists and engineers in the United States, 1973. Detailed statistical tables, appendix B,* NSF 75-312-A. Washington, D.C.: National Science Foundation, 1973.

Characteristics of Doctoral Scientists and Engineers in the United States, 1973. Detailed Statistical Tables, Appendix B, presents demographic and employment tables of data resulting from the 1973 Survey of Doctoral Scientists and Engineers conducted by the National Academy of Science for the NSF and the National Institutes of Health. Results of the survey are discussed in *Characteristics of Doctoral Scientists and Engineers in the United States, 1973* (NSF 75-312).

National Science Foundation. *Characteristics of doctoral scientists and engineers in the United States: 1977. Technical notes and detailed statistical tables,* NSF 79-306. Washington, D.C.: National Science Foundation, 1977.

Characteristics of Doctoral Scientists and Engineers in the United States: 1977 is a set of tables affording data on the demographic and employment characteristics of doctoral scientists and engineers (individuals holding S/E doctorates or holding non S/E doctorates but employed in S/E positions). Two previous surveys of this population were conducted in 1973 and 1975; some of the results from those surveys are presented here also for time-series information. Data include types of employer (education, business/industry, federal government), field, primary work activity, sex, age, race, years of experience, and other.

National Science Foundation. *Reviews of data on science resources.* June, 1978, NSF 78-310. Washington, D.C.: National Science Foundation, 1978.

Reviews of Data on Science Resources presents selecte demographic and employment characteristics of recen bachelor's- and master's-degree recipients in science an engineering. The report presents findings of a 1976 survey o the 1973-74 and 1974-75 graduating classes. Eight pages o charts and text are accompanied by two detailed statistica tables showing by field and sex the total number of graduates the number in the labor force, the number employed, the number employed in science and engineering, and the numbe in the field of training.

National Science Foundation. *Science resources studies highlights.* September 26, 1977, NSF 77-318. Washington, D.C.: National Science Foundation, 1977.

Science Resources Studies Highlights presents in this issue a summary of a report by Dr. Robert Boldt of Educationa Testing Service on the Graduate Record Exam (GRE) scores over several years. The report, *Trends in Aptitudes of Graduate Students in Science,* is a statistical analysis of scores fron 1970 to 1975 with particular emphasis on prospective scienc and engineering graduate students.

National Science Foundation. *Science resources studies highlights.* October 4, 1978, NSF 78-316, Washington, D.C.: National Science Foundation, 1978.

Science Resources Studies Highlights presents in this issu the first analytical results of the 1977 survey of doctoral scien tists and engineers (earlier surveys were in 1973 and 1975) Tables, charts and text deal with employment data by type o employer, type of work activity, sex and field of employee, i both 1973 and 1977.

Pepin, Andrew J. *Fall enrollment in higher education 1978*, (to be published by National Center for Education Statistics, DHEW, Washington, D.C.).

Fall Enrollments in Higher Education 1978 was not published at the time the *Science Education Databook* was compiled but two tables from it were used in the *Data Book:* Table 26 — Total Enrollment in Institutions of Higher Education by Major Degree Field and Sex and By Control and Level of Institution; and Table 29 — Total Enrollment in Institutions of Higher Education, by Level of Enrollment, Sex and Attendance Status of Student and By Major Degree Field and Ethnicity: Aggregate United States, Fall 1978.

Pepin, Andrew J. *Fall enrollment in higher education 1976*. (National Center for Education Statistics: Stock Number 017-080-01907-8). Washington, D.C.: U.S. Government Printing Office, 1978.

Fall Enrollment in Higher Education 1976 is the result of a single effort of the National Center for Education Statistics and the Office of Civil Rights of the Department of Health, Education, and Welfare to conduct a single fall enrollment survey that would satisfy the needs of both agencies. Data in this publication are organized under six major categories: (a) enrollment by level of instituion; (b) enrollment by state; (c) enrollment by institution; (d) Enrollment by race/ethnicity; (e) enrollment by major degree field; and (f) Enrollment by major degree field and race/ethnicity.

Phi Delta Kappa, Inc., The eleventh annual Gallup poll of the public's attitude toward the public schools. *Phi Delta Kappan*, September 1979.

The Annual Gallup Poll of the Public's Attitude Toward the Public Schools surveys a replicated probability sample of American adults to determine attitudes toward such matters as school quality, problems, strengths, finances, quality compared with previous eras, and other topics. The poll is published each September in the *Phi Delta Kappan*. It provides information useful to school decision makers and others interested in the forces that shape and support the public school system.

Smith, Stanley V. and Wells, Agnes Q. *Earned degrees conferre 1975-76*. (National Center for Education Statistics, Stock N 017-080-01868-3). Washington, D.C.: U.S. Government Printin Office, 1978.

Higher Education, Earned Degrees Conferred, 1975-76, Sun mary Data is the fifth report in a series begun in 1970-71 to po tray all degrees granted by all institutions in the United State identified as degree granting by the *Education Director Higher Education*. Detailed tables are provided in whic bachelor's, master's, and doctor's degrees are categorized b level of degree, sex of student, control (public or private) of i stitution, and discipline specialty. All data collected for surve years 1970-71 through 1975-76 are directly comparable an provide excellent data for serial and trend analyses.

U.S. Dept. of Commerce, Bureau of the Census. *Current populatio reports, Series P-20, No. 336*, Washington, D.C.: 1979.

Current Population Reports, Population Profile of the Unite States: 1978 reports on a sample survey conducted on 60,00 households. Data are considered supplementary to that of th decennial census and not strictly comparable.

U.S., Dept. of Commerce, Bureau of the Census. *1970 census population, Vol. I, U.S. Summary*, Washington, D.C.: 1975

1970 Census of Population, Vol. I, U.S. Summary provides dat on the various racial groups in the U.S., as well as othe information.

Vetter, Betty M., Babco, Eleanor L., McIntire, Judith E. *Professiona women and minorities: A manpower data resource service, 2n edition*. Washington, D.C.: Scientific Manpower Commissio November 1978.

Professional Women and Minorities: A Manpower Dat Resource Service is designed to provide current and historica statistics about the professional segment of the U.S. popula tion and particularly about the participation and availability women and minorities in pursuits requiring at least the ba calaureate level. The first five sections of the volume deal wit general enrollments, general degrees, general profession general workforce and academic workforce. The remainin sections are devoted to subject fields (chemistr mathematical sciences, life sciences, etc.) and provide dat on degrees, enrollments, general workforce, and academi workforce.

Vetter, Betty M., *Labor force participation of women trained in science and engineering and factors affecting their participation.* Unpublished report submitted to National Science Foundation under Grant No. SRS 77-19575, by Scientific Manpower Commission, Washington, D.C., June 1979.

Labor Force Participation of Women Trained in Science and Engineering and Factors Affecting Their Participation presents data on science and engineering graduates of the past 15 years regarding: employment status, salaries, number and ages of children, fields of training and work, marital status, spouses, occupations, level of degrees, etc. Thirty-seven tables are accompanied by six pages of findings and detailed discussion.

Weiss, Iris R. *Report of the 1977 national survey of science, mathematics, and social studies education.* (National Science Foundation, SE-78-72). Washington, D.C.: U.S. Government Printing Office, 1978.

Report of the 1977 National Survey of Science, Mathematics, and Social Studies Education describes the results of a national survey designed to ascertain what science courses are offered in the schools, what textbooks and materials are being used in the schools, by grade level, how much time is being spent on the teaching of science, and what are the roles of science teachers, supervisors, and administrators in working in science education. The report provides excellent base line data for comparisons with future investigations. Data were gathered from teachers (both elementary and secondary), principals, superintendents, district supervisors, and state supervisors.

Weiss, Iris R., Stake, Robert, Easley, Jack, Helgeson, Stanley L. Suydam, Marilyn N., Blosser, Patricia E., Osborne, Alan, Wiley Karen B., & Race, Jeanne. *The status of pre-college science mathematics, and social studies educational practices in U.S schools: An overview and summaries of three studies* (National Science Foundation, SE-78-71). Washington, D.C.: U.S Government Printing Office, 1978.

The Status of Pre-College Science, Mathematics, and Socia Studies Educational Practices in U.S. Schools: An Overvie and Summaries of Three Studies is a summary of the thre studies: (a) the 1977 National Survey of Science, Mathematic and Social Studies Education conducted by the Researc Triangle Institute of North Carolina; (b) Case Studies i Science Education conducted by the Center for Instructiona Research and Curriculum Evaluation of the University of I linois; and (c) The Status of Pre-College Scienc Mathematics, and Social Science Education: 1955-75 (Literature Review) conducted by the Center for Science an Mathematics Education, The Ohio State University. Thes studies were designed to assess the current status of pr college science education in the United States.

SUPPLEMENTARY BIBLIOGRAPHY

Aaron, Henry J. *Healthy, wealthy, and wise: Back door approaches to education* (An Occasional Paper of the Aspen Institute for Humanistic Studies). Cambridge, Massachusetts: Aspen Institute for Humanistic Studies, 1976.

Anderson, J. G. Causal models and social indicators: Toward the development of social systems models. *American Sociological Review*, 1973, *38*, 285-301.

Association of Science-Technology Centers. *Preliminary report: Summary of ASTC member museums that have responded to the Membership Directory Questionnaire, 1978.* Unpublished report, Washington, D.C., 1978.

Baster, N. (Ed.), *Measuring development: The role and adequacy of development indicators.* London: F. Cass, 1968.

Bauer, R. (Ed.) *Social indicators.* Cambridge, Mass.: Massachusetts Institute of Technology Press, 1966.

Belt, S. L. *Measuring attitudes of high school pupils toward science and scientists* (RM-59-14). Educational Testing Service: Princeton, New Jersey, December 1959.

Beyer, J. M. & Snipper, R. Objective versus subjective indicators of quality in graduate education. *Sociology of Education*, 1974, *47*, 541-557.

Biderman, A. D. Social indicators and goals. In Raymond A. Bauer, (Ed.), *Social indicators.* Cambridge, Mass.: Massachusetts Institute of Technology Press, 1966.

Blalock, H. M., Jr. (Ed.) *Measurement in the social sciences: Theories and strategies.* Chicago: Aldine, 1974.

Bureau of Labor Statistics. *Occupational outlook handbook, 1976-77 edition.* Washington, D.C.: U.S. Government Printing Office, 1976.

Carpenter, Thomas, Coburn, Terrence G., Reyes, Robert E., and Wilson, James. *Results from the first mathematics assessment of the National Assessment of Educational Progress.* Reston, Virginia: National Council of Teachers of Mathematics, 1978.

Clemmer, R., Fairbanks, R., Hall, D., Impara, J., & Nelson, C. *Indicators and statewide assessment*, Salem, Oregon: State Department of Education, 1973.

Conference Board of the Mathematical Sciences, National Advisory Committee on Mathematical Education. *Overview and analyses of school mathematics: Grades K-12.* Washington, D.C.: Conference Board of the Mathematical Sciences, 1975.

Congressional Information Service. *American statistical index* Washington, D.C.: The Service, 1973-79.

Davis, Kay and Kimche, Lee. *Survey of education programs a science-technology centers.* Washington, D.C.: Association o Science-Technology Centers, 1976.

de Neufville, J. I. *Social indicators and public policy: Interactiv processes of design and application.* New York: Elevier, 197

Eckland, Bruce K. and Bailey, J. P. Jr. *National longitudinal stud of the high school class of 1972: A catalog description of sec ond follow-up survey data, October 1974.* (National Center fo Education Statistics, NCES 77-265). Washington, D.C.: U.S Government Printing Office, 1977.

Eckland, Bruce K. and Wisenbaker, Joseph M. *Nation longitudinal study: A capsule description of young adults fou and one-half years after high school* (RTI/884/51-015). Researc Triangle Park, North Carolina: Research Triangle Institute 1979.

Educational Testing Service. *National longitudinal study of th high school class of 1972: Student questionnaire.* (U.S. Offic of Education, DE Form 2348, 2/72). Princeton: Author, 1972.

Elam, Stanley M. (Ed.) *A decade of Gallup polls of attitudes towar education, 1969-1978.* Bloomington, Indiana: Phi Delta Kappa 1978.

Elkana, Y., Lederberg, J., Merton, R. K., Thackray, A., and Zucker man, H. (Eds.) *Toward a metric of science: The advent o science indicators.* New York: Wiley, 1978.

Feller, B. *Directory of federal agency education data tapes* Washington, D.C.: U.S. Government Printing Office, 1976.

Felson, M., & Land, K. C. *Social, demographic and economic inte relationships with educational trends in the United States 1947-74.* Presented at the Annual Meeting of the America Sociological Association, Chicago, Illinois, August 1977.

Ferris, Abbott L. *Indicators of change in the American family.* Ne York: Russell Sage Foundation, 1970.

Ferriss, Abbott, L. *Indicators of trends in American education.* Ne York: Russell Sage, 1969.

Ferriss, Abbott, L. *Indicators of trends in the status of America women.* New York: Russell Sage Foundation, 1971.

Ferriss, Abbott, L. Monitoring and interpreting turning points i educational indicators. *Social Indicators Research*, 1974, 73-84.

Fetters, William B. *National longitudinal study of the high school class of 1972: A capsule description of high school seniors, base-year survey.* (National Center for Education Statistics, DHEW Publication No. (OE) 74-11116). Washington, D.C.: U.S. Government Printing Office, 1974.

Fey, James L., Albers, Donald J., and Jewett, John. *Undergraduate mathematical sciences in universities, four-year colleges and two-year colleges. 1975-76.* Washington, D.C.: Conference Board of the Mathematical Seminar, 1976.

Foster, Betty J. and Carpenter, Judi M. *Statistics of public elementary and secondary day schools, fall 1976.* (National Center for Education Statistics, Stock No. 017-080-01834-9). Washington, D.C.: U.S. Government Printing Office, 1978.

Fox, K. *Social indicators and social theory.* New York: Wiley, 1974.

Frank, P. (Ed.) *The validation of scientific theories.* Boston: Beacon, 1956.

Gilmartin, K. J., Rossi, R. J., Lutomski, L. S., and Reed, D. F. B. *Social indicators: An annotated bibliography of current literature.* New York: Garland, 1979.

Glass, G. V., Willson, V. L., and Gottman, J. M. *Design and analysis of time-series experiments.* Boulder: Colorado Press, 1975.

Glitter, A. G., and Peterson, R. P. *Toward a social indicator of education: A pilot study.* Boston University, CRC Report No. 44, 1970.

Gross, B. (Ed.) *Social intelligence for America's future: Explorations in societal problems.* Boston: Allyn and Bacon, 1969.

Hamblen, John W. and Landis, Carolyn P. *The fourth inventory of computers in higher education: An interpretive report.* Boulder, Colorado: Westview Press, 1980.

Hannan, E. J. *Time series analysis.* London: Methein Monographs, 1960.

Hargan, Carol and Hunter, Beverly. *Instructional computer . . . ten case studies.* Alexandria, Va.: Human Resources Research Organization, 1978.

Harnischfeger, Annegret and Wiley, David E. *Achievement test score decline: Do we need to worry?* St. Louis, Mo.: CEMREL, Inc., 1975.

Harris, C. W. *Problems in measuring change.* Madison: University of Wisconsin Press, 1963.

Hastings, P. K., and Southwick, J. C. (Eds.) *Survey data for trend analysis: An index to repeated questions in U.S. national surveys held by the Roper Public Research Center.* Williamstown, Mass.: Roper Public Opinion Research Center, 1974.

Hauser, P. M. *Social statistics in use.* New York: Russell Sage Foundation, 1975.

Helgeson, Stanley L., Blosser, Patricia E., and Howe, Robert W. *The status of pre-college science, mathematics, and social science education: Volume I, science education* (National Science Foundation, SE-78-73). Washington, D.C.: U.S. Government Printing Office, 1978.

Holton, Gerald. Can science be measured? In R. K. Merton, et al (Eds.), *Toward a metric of science: The advent of science indicators.* New York: Wiley, 1978.

Holton, Gerald. Limits of scientific inquiry. *Daedalus*, Spring, 1978, 227-234.

Human Resources Research Organization. *Academic computing directory.* Alexandria, Va.: Human Resources Research Organization, 1977.

Hunter, Beverly. What makes a computer literate college? *Proceedings of the Ninth Conference on Computers in the Undergraduate Curricula.* Denver, Colorado: University of Denver, 1978.

Inter-University Consortium for Political and Social Research. *Guide to resources and services.* Ann Arbor, Mich.: University of Michigan, 1978.

Irvine, D. J. *Performance indicators in education,* Albany, N.Y.: N.Y. State Education Department, 1968.

Kaplan, A. *The conduct of inquiry.* San Francisco: Chandler, 1964.

Keppel, Francis. *Educational policy in the next decade* (An Occasional Paper of the Aspen Institute for Humanistic Studies). Cambridge, Massachusetts: Aspen Institute for Humanistic Studies, 1976.

King, M. A. Primary and secondary indicators of education. In A. Shonfield and S. Shaw (Eds.), *Social indicators and socia policy.* London: Heinemann Books, 1972.

Kish, L. *Survey sampling.* New York: John Wiley and Sons, 1965.

Land, K. C. On the definition of social indicators. *American sociologist,* 1971, *6,* 322-325.

Land, K. C. Social indicator models: An overview. In K. C. Land and S. Spilerman (Eds.), *Social indicator models.* New York Russell Sage Foundation, 1975.

Land, K. C. Theories, models and indicators of social change. *International Social Science Journal,* 1975(b), *27,* 7-37.

Land, K. C. and Spilerman, S. (Eds.), *Social indicator models.* New York: Russell Sage Foundation, 1975.

Mansfield, E. Determination of the speed of application of new technology. In R. B. Williams (Ed.), *Science and technology in economic growth.* New York: Halstead, 1973.

Mead, Margaret and Metraux, Rhoda. Image of the scientist among high school students: A pilot study. *Science,* 1957, *126,* 384-390.

Merriam, I. C. Welfare and its measurement. In E. B. Sheldon and W. E. Moore (Eds.), *Indicators of social change: Concepts and measurements,* New York: Russell Sage Foundation, 1968, 721-784.

Messick, S. The standard problem. Meaning and values in measurement and evaluation. *American Psychologist,* 1975, *30,* 955-966.

Michalos, A. E. (Ed.) *Social indicators research* (4 vols.). Dordrecht, Holland: D. Reidel, 1977.

Miller, R. B. Tools for evaluation of the study of social change? *Annual Convention of the American Educational Research Association,* 1977.

Moser, C. A., and Kalton, G. *Survey methods in social investigation.* (2nd ed.). New York: Basic Books, Inc., 1972.

Mosteller, F., and Tukey, J. Data analysis, including statistics. In G. Lindzey and E. Aronson, (Eds.), *Handbook of Social Psychology,* (2nd ed.). Vol. 2. *Research Methods.* Reading, Mass.: Addison-Wesley, 1968.

Mushkin, Selma J. and Stageberg, Stephen. *National assessment and social indicators, January 1973.* (National Center for Education Statistics). Washington, D.C.: U.S. Government Printing Office, 1973.

National Center for Education Statistics. *The condition of education, 1977.* Washington, D.C.: U.S. Government Printing Office, 1977.

National longitudinal study of the high school class of 1972. See entries: Eckland, Bruce K. and Bailey, J. P. Jr.; Eckland, Bruce K. and Wisenbaker, Joseph M.; Educational Testing Service; Fetters, William B.; Perg, Samuel S., et al; Research Triangle Institute (four entries).

National Science Board. *Science indicators, 1978.* (National Science Foundation, Stock No. 038-000-00416-6). Washington, D.C.: U.S. Government Printing Office, 1979.

National Science Foundation. *Guide to programs, fiscal year 1980* Washington, D.C.: U.S. Government Printing Office, 1979.

National Science Foundation. *National patterns of R&D resourc Trends and personnel in the United States, 1953-1978-19* (National Science Foundation 78-313). Washington, D.C.: U Government Printing Office, October 1978.

National Science Foundation. *Early adolescence: Perspectives a recommendations.* (SE 78-75, Stock No. 038-000-00390 Washington, D.C.: U.S. Government Printing Offi September 1978.

National Science Foundation. *Science and technology: Ann report to the Congress* (Stock No. 038-000-00396 Washington, D.C.: U.S. Government Printing Office, Aug 1978.

National Science Foundation. *Statistical handbook of scie education* (NSF 60-13). Washington, D.C.: U.S. Governm Printing Office, 1960.

O'Keefe, Michael. *The adult, education and public policy.* (An Oc sional Paper of the Aspen Institute for Humanistic Studie Cambridge, Massachusetts: Aspen Institute for Humanis Studies, 1976.

Olkinuora, E. On the problems of developing education indicato *Acta Sociologica,* 1972, *16,* 284-302.

Ostendorf, Logan C. and Horn, Paul J. *Course offerin enrollments, and curriculum practices in public second schools, 1972-73.* (National Center for Education Statistic Washington, D.C.: U.S. Government Printing Office, 1976.

Parke, R., and Seidman, D. Social indicators and social reporti *The Annals of the American Academy,* 1978, *435,* 1-22.

Parke, R., and Sheldon, E. B. Social statistics for public policy. *P ceedings of the American Statistical Association,* 19 105-112.

Perg, Samuel S., Wisenbaker, Joseph M., Bailey, Susan S., a Marnell, Dara. *Tabular summary of the third follow-up qu tionnaire data* (Contract No. OEC-0-73-6666) — Resea Triangle Park, N.C.: Research Triangle Institute, 1979.

Research Triangle Institute, *National longitudinal study of the hi school class of 1972: A capsule description of first follow- survey data.* (National Center for Education Statistics, NC 76-216, Stock No. 017-080-01517-0). Washington, D.C.: U Government Printing Office, 1976.

Research Triangle Institute. *National longitudinal study of the hi school class of 1972: first follow-up questionnaire, form* (U.S. Office of Education, DE Form 2367, 9/73). Resea Triangle Park, N.C.: Author, 1973.

Research Triangle Institute. *National longitudinal study of the high school class of 1972: Second follow-up questionnaire.* (Department of Health, Education, and Welfare, DE Form 2367-2). Research Triangle Park, N.C.: Author, 1974.

Research Triangle Institute. *National longitudinal study of the high school class of 1972: Third follow-up questionnaire.* (Department of Health, Education, and Welfare, DE Form 2367-5). Research Triangle Park, N.C.: Author, 1976.

Rossi, Robert J. and Gilmartin, Kevin J. *Report on a feasibility study to develop youth-specific social indicators and data source directory.* Palo Alto, California: American Institutes for Research, August 1978.

Sheldon, E. B. and Freeman, H. E. Notes on social indicators: Promises and potential. *Policy Sciences,* 1976, *1,* 97-111.

Sheldon, E. B. and Moore, W. E. (Eds.), *Indicators of social change: Concepts and measurements.* New York: Russell Sage Foundation, 1968.

Sheldon, E. B. and Parke, R. Social indicators. *Science,* 1975, *188,* 693-699.

Sheldon, E. B. The social indicators movement. In *Educational Indicators: Monitoring the State of Education, Proceedings of the 1975 Educational Testing Service Invitational Conference,* Princeton, N.J.: Educational Testing Service, 1975, 3-10.

Social Indicators Research Program. *Report on a feasibility study to develop youth-specific social indicators and data source directory.* Technical report to the Youth Development Bureau, DHEW. Palo Alto, California: American Institutes for Research, 1977.

Social Science Research Council. *Annual report, 1976-77.* New York: Author, 1977.

Stake, Robert E. and Easley, Jack A. Jr. *Case studies in science education. Volume I, The case reports. Volume II, Design, overview and general findings.* (National Science Foundation, SE-78-74). Washington, D.C.: U.S. Government Printing Office, 1978.

Suydam, Marilyn N. and Osborne, Alan. *The status of pre-college science, mathematics, and social science education 1955-1975: Volume II, Mathematics Education* (National Science Foundation, SE-78-73). Washington, D.C.: U.S. Government Printing Office, 1978.

Terleckyj, Nestor E. (Ed.). *The state of science and research: Some new indicators.* Boulder, Colorado: Westview Press, 1977.

Thomas, T.C. and Larson, M. A. *Educational indicators and educational policy.* New York: Aspen Institute, 1976.

United States Commission on Civil Rights. *Social indicators o equality for minorities and women.* Washington, D.C.: Autho 1978.

U.S. Department of Commerce. *Social indicators, 197* Washington, D.C.: U.S. Government Printing Office, 1977.

U.S. Department of Labor. *Directory of data sources on racial an ethnic minorities* (BLS Bulletin #1879). Washington, D.C.: U.S Government Printing Office, 1975.

van der Smissen, Betty. *Indicators of change in the recreational e vironment — national research symposium* (Penn State HPE Series No. 6). University Park, Penn. The Pennsylvania Sta University, 1975.

Williams, Jeffrey W. *Students and schools.* (National Center f Education Statistics). Washington, D.C.: U.S. Department o Health, Education, and Welfare, 1979.

Woellner, Elizabeth H. *Requirements for certification of teacher counselors, librarians, administrators.* Chicago: The Univers ty of Chicago Press, 1978.

Wiley, Karen B. and Race, Jeanne. *The status of pre-colleg science, mathematics, and social science educatio 1955-1975, Volume III, Social Science Education* (Nation Science Foundation, SE 78-73). Washington, D.C.: U.S. Gover ment Printing Office, 1978.

Zuckerman, H., and Miller, R. B. *Social indicators and science i dicators.* Unpublished manuscript, 1978.